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TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

TWENTY-FIRST ANNUAL SESSION,

HELD AT NEW YORK,

COMMENCING ON THE 11TH OF JULY, 1881.

PUBLICATION COMMITTEE:

GEO. H. CUSHING, M. S. DEAN, E. T. DARBY.

PHILADELPHIA:
THE S. S. WHITE DENTAL MANUFACTURING CO.
1882.

DISCLAIMER.

The American Dental Association, although formally accepting and publishing the reports of the various Standing Committees, and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution.—*Constitution.*

LIST OF OFFICERS FROM DATE OF ORGANIZATION.

PRELIMINARY CONVENTION, NIAGARA FALLS, AUGUST, 1859.

President,	W. W. ALLPORT	Chicago.
Secretary,	J. TAFT	Cincinnati.

ORGANIZATION AND FIRST SESSION OF ASSOCIATION, WASHINGTON, D. C., JULY, 1860.

[Annual meetings to be hereafter last Tuesday in July.]

President,	W. H. ATKINSON	Cleveland.
1st Vice-President,	J. B. GIBBS	Washington, D. C.
2d Vice-President,	W. CAHOON	Detroit, Mich.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	W. MUIR ROGERS	Shelbyville, Ky.
Treasurer,	S. DILLINGHAM	Philadelphia.

[NO MEETING IN 1861.]

CLEVELAND, JULY, 1862.

President,	GEO. WATT	Xenia, Ohio.
1st Vice-President,	W. H. ALLEN	New York City.
2d Vice-President,	W. D. STONE	Lexington, Ky.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	J. F. JOHNSTON	Indianapolis.
Treasurer,	W. A. PEASE	Dayton, Ohio.

PHILADELPHIA, JULY, 1863.

President,	W. H. ALLEN	New York City.
1st Vice-President,	J. H. MCQUILLEN	Philadelphia.
2d Vice-President,	WM. B. HURD	Brooklyn, N. Y.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	C. R. BUTLER	Cleveland.
Treasurer,	A. C. HAWES	New York City.

NIAGARA FALLS, JULY, 1864.

President,	J. H. MCQUILLEN	Philadelphia.
1st Vice-President,	C. P. FITCH	New York City.
2d Vice-President,	H. BENEDICT	Detroit.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	GEO. W. ELLIS	Philadelphia.
Treasurer,	I. J. WETHERBEE	Boston.

CHICAGO, JULY, 1865.

President,	C. W. SPALDING	St. Louis.
1st Vice-President,	GEO. H. CUSHING	Chicago.
2d Vice-President,	JAS. MCMANUS	Hartford.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	L. D. SHEPARD	Boston.
Treasurer,	I. J. WETHERBEE	Boston.

BOSTON, JULY, 1866.

President,	C. P. FITCH	New York City.
1st Vice-President,	W. H. MORGAN	Nashville.
2d Vice-President,	L. D. SHEPARD	Boston.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	A. HILL	Norwalk, Conn.
Treasurer,	W. W. SHEFFIELD	New London, Conn.

CINCINNATI, JULY, 1867.

President,	A. LAWRENCE	Lowell, Mass.
1st Vice-President,	P. G. C. HUNT	Indianapolis, Ind.
2d Vice-President,	A. S. TALBERT	Lexington, Ky.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	C. R. BUTLER	Cleveland.
Treasurer,	W. H. GODDARD	Louisville, Ky.

NIAGARA FALLS, JULY, 1868.

President,	JONATHAN TAFT	Cincinnati.
1st Vice-President,	HOMER JUDD	St. Louis.
2d Vice-President,	A. A. BLOUNT	Springfield, Ohio.
Recording Secretary,	EDGAR PARK	St. Louis.
Corresponding Secretary,	JAS. MCMANUS	Hartford.
Treasurer,	W. H. GODDARD	Louisville.

SARATOGA SPRINGS, AUGUST, 1869.*

President,	HOMER JUDD	St. Louis.
1st Vice-President,	S. J. COBB	Nashville.
2d Vice-President,	C. E. FRANCIS	New York City.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	I. A. SALMON	Boston.
Treasurer,	W. H. GODDARD	Louisville.

NASHVILLE, AUGUST, 1870.

President,	W. H. MORGAN	Nashville.
1st Vice-President,	S. W. DENNIS	San Francisco.
2d Vice-President,	J. R. WALKER	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	I. A. SALMON	Boston.
Treasurer,	W. H. GODDARD	Louisville.

*Owing to a change in the Constitution, officers elected at this and the sessions following served at the next annual meeting subsequent to their election; and the sessions of and after 1869 commenced on the first Tuesday in August.

White Sulphur Springs, Va., August, 1871.

President,	Geo. H. Cushing	Chicago.
1st Vice-President,	C. E. Francis	New York City.
2d Vice-President,	J. R. Walker	New Orleans.
Recording Secretary,	M. S. Dean	Chicago.
Corresponding Secretary,	I. A. Salmon	Boston.
Treasurer,	W. H. Goddard	Louisville.

Niagara Falls, August, 1872.

President,	P. G. C. Hunt	Indianapolis.
1st Vice-President,	L. D. Shepard	Boston.
2d Vice-President,	G. A. Mills	Brooklyn, N. Y.
Recording Secretary,	M. S. Dean	Chicago.
Corresponding Secretary,	J. Taft	Cincinnati.
Treasurer,	W. H. Goddard	Louisville.

Put-in-Bay, August, 1873.

President,	T. L. Buckingham	Philadelphia.
1st Vice-President,	Isaiah Forbes	St. Louis.
2d Vice-President,	A. F. McLain	New Orleans.
Recording Secretary,	M. S. Dean	Chicago.
Corresponding Secretary,	J. Taft	Cincinnati.
Treasurer,	W. H. Goddard	Louisville.

Detroit, August, 1874.

President,	M. S. Dean	Chicago.
1st Vice-President,	Geo. W. Keely	Oxford, Ohio.
2d Vice-President,	J. S. Knapp	New Orleans.
Recording Secretary,	C. Stoddard Smith	Springfield, Ill.
Corresponding Secretary,	Geo. L. Field	Detroit.
Treasurer,	W. H. Goddard	Louisville.

Niagara Falls, August, 1875.

President,	A. L. Northrop	New York City.
1st Vice-President,	H. J. McKellops	St. Louis.
2d Vice-President,	H. A. Smith	Cincinnati.
Recording Secretary,	C. Stoddard Smith	Springfield, Ill.
Corresponding Secretary,	J. H. McQuillen	Philadelphia.
Treasurer,	W. H. Goddard	Louisville.

Philadelphia, August, 1876.

President,	Geo. W. Keely	Oxford, Ohio.
1st Vice-President,	C. N. Peirce	Philadelphia.
2d Vice-President,	Corydon Palmer	New York City.
Recording Secretary,	C. Stoddard Smith	Springfield, Ill.
Corresponding Secretary,	J. H. McQuillen	Philadelphia.
Treasurer,	W. H. Goddard	Louisville.

CHICAGO, AUGUST, 1877.

President,	F. H. REHWINKEL	Chillicothe, Ohio.
1st Vice-President,	L. D. SHEPARD	Boston.
2d Vice-President,	GEO. T. BARKER	Philadelphia.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	M. H. WEBB	Lancaster, Pa.
Treasurer,	W. H. GODDARD	Louisville.

NIAGARA FALLS, AUGUST, 1878.

President,	H. J. MCKELLOPS	St. Louis.
1st Vice-President,	L. D. SHEPARD	Boston.
2d Vice-President,	L. D. CARPENTER	Atlanta, Ga.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	A. O. RAWLS	Lexington, Ky.
Treasurer,	W. H. GODDARD	Louisville.

NIAGARA FALLS, AUGUST, 1879.

President,	L. D. SHEPARD	Boston.
1st Vice-President,	C. N. PEIRCE	Philadelphia.
2d Vice-President,	GEO. L. FIELD	Detroit.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	M. H. WEBB	Lancaster, Pa.
Treasurer,	W. H. GODDARD	Louisville.

BOSTON, AUGUST, 1880.

President,	C. N. PEIRCE	Philadelphia.
1st Vice-President,	W. C. BARRETT	Buffalo.
2d Vice-President,	GEO. J. FRIEDRICHS	New Orleans.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	A. M. DUDLEY	Salem, Mass.
Treasurer,	W. H. GODDARD	Louisville.

NEW YORK, JULY, 1881.

President,	H. A. SMITH	Cincinnati.
1st Vice-President,	W. C. BARRETT	Buffalo.
2d Vice-President,	GEO. J. FRIEDRICHS	New Orleans.
Recording Secretary,	GEO. H. CUSHING	Chicago.
Corresponding Secretary,	A. M. DUDLEY	Salem, Mass.
Treasurer,	W. H. GODDARD	Louisville.

EXECUTIVE COMMITTEE FOR SESSION OF 1882.

J. N. CROUSE, Chairman. C. S. STOCKTON, Secretary.

FIRST DIVISION—COMMITTEE OF ARRANGEMENTS.

*COOK, ODELL, AND MOORE.

SECOND DIVISION—ON CREDENTIALS, ETHICS, AND AUDITING ACCOUNTS.

*CROUSE, *STOCKTON, AND PERRY.

THIRD DIVISION—ON VOLUNTEER ESSAYS.

PEIRCE, MORGAN, AND REHWINKEL.

* These go out August, 1882.

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1881.

BY GEO. H. CUSHING, SECRETARY.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Twenty-first Annual Session at Irving Hall, New York City, Tuesday, July 12, 1881, at 11 o'clock, A.M., the President, C. N. Peirce, in the Chair.

The session was opened with prayer by Dr. I. J. Wetherbee.

The roll of qualified members was then called, and the following were found either to be present or to have forwarded their dues:

ATKINSON, WM. H.	41 East Ninth st., New York.
ABBOTT, FRANK	22 West Fortieth st., New York.
ALLEN, JOHN	314 Fifth ave., New York.
ANDREWS, ROBERT R.	Cambridge, Mass.
ADAMS, J. F.	Worcester, Mass.
ALLEN, WM. H.	18 West Eleventh st., New York.
* BROWN, SENECA B.	Fort Wayne, Ind.
* BAUER, JOSEPH	130 Esplanade st., New Orleans.
BUCKINGHAM, T. L.	1228 Arch st., Philadelphia.
BARRETT, W. C.	11 West Chippewa st., Buffalo, N. Y.
* BRACKETT, C. A.	64 Touro st., Newport, R. I.
BROPHY, T. W.	125 State st., Chicago.
BARKER, WM.	283 Westminster st., Providence, R. I.
BRYAN, LYMAN C.	1202 Washington st., Boston.
BRONSON, W. A.	8 East Thirty-fourth st., New York.
* BOGUE, E. A.	29 East Twentieth st., New York.
BÖDECKER, C. F. W.	54 East Fifty-eighth st., New York.
* BUCKLAND, A. W.	Woonsocket, R. I.
BECK, C. S.	Wilkesbarre, Pennsylvania.

Those marked thus (*) were absent but sent their dues.

Butler, Charles R.	Cleveland, Ohio.
Bishop, J. Adams	32 West Thirty-sixth st., New York.
Brown, G. Carleton	116 Broad st., Elizabeth, New Jersey.
Brockway, A. H.	13 Greene ave., Brooklyn, N. Y.
Crouse, J. N.	2101 Michigan ave., Chicago.
Chandler, Thos. H.	74 Commonwealth ave., Boston.
* Cleland, Jas.	Detroit, Michigan.
* Cowie, Henry	Detroit, Michigan.
Coburn, H. W.	Lowell, Mass.
Chaim, M. L.	30 Cooper Institute, New York.
Cushing, Geo. H.	34 Monroe st., Chicago.
Coolidge, J. B.	2304 Tremont st., Boston.
Clapp, D. M.	196 Boylston st., Boston.
Colton, A.	Hudson, N. Y.
Cook, C. D.	133 Pacific st., Brooklyn, N. Y.
* Colgrove, W. H.	Johnstown, N. Y.
Canine, J. F.	Louisville, Ky.
* Davis, E. B.	Concord, N. H.
* Davis, K. B.	Springfield, Ill.
Darby, E. T.	1513 Walnut st., Philadelphia.
Dudley, A. M.	223 Essex st., Salem, Mass.
Dodge, Miles H.	20 East Thirty-third st., New York.
* Dean, M. S.	34 Monroe st., Chicago.
Dickerman, D. S.	Taunton, Mass.
Davenport, I. B.	Williamstown, Mass.
Davenport, S. E.	Northampton, Mass.
Emminger, A. F.	Columbus, Ohio.
Friedrichs, Geo. J.	155 St. Charles st., New Orleans.
Farrar, J. N.	15 Greene ave., Brooklyn, N. Y.
Field, Geo. L.	Detroit, Michigan.
Fundenburg, W. H.	323 Penn ave., Pittsburg, Penn.
* Fillebrown, Thos.	Portland, Maine.
Filbert, P. K.	Pottsville, Penn.
* Finley, M. F.	Ypsilanti, Michigan.
* Freeman, A. W.	1354 Wabash ave., Chicago.
Flagg, Eben M.	22 West Eleventh st., New York.
Goddard, Wm. H.	Louisville, Ky.
Grant, Geo. F.	86 Pinckney st., Boston.
Guilford, S. H.	4006 Chestnut st., Philadelphia.
Gerry, G. A.	Lowell, Mass.
Gaylord, E. S.	New Haven, Conn.
* Harrington, D. G.	Boston, Mass.
Hoysradt, G. W.	Ithaca, N. Y.
* Hill, J. L.	Gettysburg, Penn.
Hunter, E.	Jackson, Mich.
* Holmes, E. S.	Grand Rapids, Mich.
* Ingersoll, L. C.	Keokuk, Iowa.

Jarvie, Wm., Jr.	Brooklyn, N. Y.
Jones, W. H.	Northampton, Mass.
Klump, G. W.	Williamsport, Penn.
* Keely, Geo. W.	Oxford, Ohio.
* Kitchen, C. A.	Rockford, Ill.
* Kingsbury, C. A.	Philadelphia.
Lathrop, Joseph	Detroit, Mich.
Litch, Wilbur F.	1627 Chestnut st., Philadelphia.
Lord, Benjamin	New York.
Leech, H. K.	3610 Market st., Philadelphia.
La Roche, W. T.	67 West Fifty-fourth st., New York.
McKellops, H. J.	2630 Washington ave., St. Louis.
Mills, Geo. A.	169½ Columbia Heights, Brooklyn, N. Y.
Meriam, H. C.	257 Essex st., Salem, Mass.
Meigs, Geo. S.	113 West Thirty-fourth st., New York.
Moore, Thos. T.	Columbia, S. C.
McManus, Jas.	Hartford, Conn.
Merritt, Charles	25 West Twenty-third st., New York.
* Morrison, W. N.	1337 Washington ave., St. Louis.
McNaughton, D. C.	Jersey City, N. J.
McDougall, S. J.	375 Columbus ave., Boston.
Morgan, N.	394 Main st., Springfield, Mass.
Meloney, C. W.	29 East Twentieth st., New York.
Niles, E. S.	146 Boylston st., Boston.
Neall, E. H.	1314 Arch st., Philadelphia.
* Noble, H. B.	1111 Pennsylvania ave., Washington.
Osgood, C. H.	147 Tremont st., Boston.
Odell, Frank M.	18 West Eleventh st., New York.
Peirce, C. N.	1415 Walnut st., Philadelphia.
Page, W. E.	Charlestown District, Boston.
Priest, A. N.	Utica, N. Y.
Partridge, Charles W.	Lawrence, Mass.
Pettee, A. L.	Brattleboro, Vermont.
Palmer, S. B.	39½ Warren st., Syracuse, N. Y.
Palmer, James G.	New Brunswick, N. J.
Parker, C. B.	152 Clinton st., Brooklyn, N. Y.
Rehwinkel, F. H.	Chillicothe, Ohio.
Rideout, Leon	Lynn, Mass.
Rhein, Meyer L.	7 West Thirty-eighth st., New York.
Shepard, L. D.	100 Boylston st., Boston.
Smith, J. H.	New Haven, Conn.
Shumway, T. D.	Plymouth, Mass.
* Stevens, S. G.	Lynn, Mass.
Starbuck, W. C.	Jamaica Plain, Mass.
* Stellwagen, T. C.	1627 Chestnut st., Philadelphia.
Stockton, C. S.	Newark, N. J.
Smith, H. A.	286 Race st., Cincinnati.

Smith, D. D.	1417 Walnut st., Philadelphia.
Searle, Flavius	Springfield, Mass.
* Swasey, J. A.	3003 Michigan ave., Chicago.
* Seabury, F. N.	Providence, R. I.
Taft, J.	117 West Fourth st., Cincinnati, Ohio.
Tillinghast, W. H.	220 Westminster st., Providence, R. I.
Talbot, E. S.	125 State st., Chicago.
Toledo, M. V.	113 East Eighteenth st., New York.
Wetherbee, I. J.	46 Dover st., Boston.
Watkins, S. C. G.	Montclair, N. J.
Waters, Geo. F.	8 Beacon st., Boston.
Webb, M. H.	Lancaster, Penn.
Watling, J. A.	Ypsilanti, Mich.
Woodward, C. A.	318 Madison ave., New York.
* Werner, J. G. W.	41 Upton st., Boston.
* Whinery, J. C.	Salem, Ohio.

On motion, the reading of the printed minutes of last year's meeting was dispensed with.

The President then read his address.

The following amendment to the Constitution offered last year by Dr. Priest was then adopted:

To add to Section 5 of Article III. of the Constitution, under the head of "Permanent Members," "After the resignation of a member has been accepted, the Association may, at any time thereafter, reinstate such member by unanimous consent."

The following amendment to the Constitution offered last year by Dr. Dean was also adopted:

To amend Section 1 of Article VI. of the Constitution so that the first sentence shall read "To prepare, arrange, and expedite business, this Association shall be divided into seven Sections, as follows:" And to change Section V. so as to read "Anatomy, Histology, and Microscopy," and to add "Section VII., Physiology and Etiology."

On motion of Dr. Shepard the following hours of meeting and adjournment were adopted: 9 to 12.30 A. M., 2 to 5 P. M., and 8 P. M. to adjournment.

The following resolution offered by Dr. Shepard was then adopted:

Resolved, That the action of the officers of this Association in calling this meeting in advance of the regular time designated by the Constitution is hereby approved and made the act of the Association.

The Publication Committee offered the following report, which was accepted and its suggestions adopted:

The Publication Committee would respectfully submit the following report:

In accordance with the instructions of the Association they opened correspondence with different publishers regarding the printing of the Transactions; finally accepting the proposition of the Trustees of S. S. White.

Three hundred copies of Transactions were furnished the Association, of which about two hundred and thirty-five copies have been duly distributed as per the Treasurer's list, and to the various libraries, universities, journals, and honorary members.

Of the character of the work done by the Trustees of S. S. White, the volume speaks for itself; but the Association can not know how much it owes to these gentlemen, and particularly to Mr. Hise, who had charge of the publishing department.

Without the very intelligent and diligent services they rendered, you could not have had so fine an edition of Transactions, while your editor and publishers were so widely separated.

The committee feel that the warm thanks of the Association are due to the gentlemen above named for the valuable services they have rendered.

The following is a statement of the financial condition:

Received of Treasurer	$30 00
From sale of Transactions	3 75
	$33 75
Expended for postage, envelopes, paper, expressage, and incidental expenses	$44 15
Due the Committee	$10 40

Respectfully,

GEO. H. CUSHING, *Chairman.*

We have examined the above report and find it correct.

C. S. STOCKTON, J. N. CROUSE, } *Ex. Com.*

On motion of Dr. Crouse it was voted to devote this afternoon to work in the Sections, and that when we adjourn, we do so to meet at 8 o'clock P. M.

Announcements of the time and place of meeting of the different Sections were then made.

The Committee on Credentials then made a partial report, which was subsequently completed as follows:

Alumni Association of Boston Dental College—Lyman C. Bryan, W. C. Starbuck.

American Academy of Dental Science—H. C. Meriam.
Boston Dental College—I. J. Wetherbee.
Brooklyn Dental Society—C. B. Parker.
Central Dental Association of Northern New Jersey—G. Carleton Brown, J. G Palmer.
Chicago Dental Society—T. W. Brophy, E. S. Talbot.
Connecticut Valley Dental Association—J. F. Adams, A. L. Pettee, N. Morgan, S. E. Davenport, W. H. Jones.
First District Dental Society of the State of New York—M. H. Dodge, J. A Bishop, C. Merritt, G. S. Meigs, W. T. La Roche, M. L. Rhein, M. V. Toledo, C. A. Woodward.
Harvard Odontological Society—E. S. Niles, W. E. Page.
Illinois State Dental Society—Geo. H. Cushing, J. N. Crouse.
Kentucky State Dental Society—Wm. H. Goddard, J. F. Canine.
Massachusetts Dental Society—D. M. Clapp, F. Searle.
Merrimack Valley Dental Society—J. B. Coolidge, G. F. Grant, G. A. Gerry, C. W. Partridge, W. H. Tillinghast.
Michigan Dental Association—E. Hunter.
New Jersey State Dental Society—C. S. Stockton, C. W. Meloney, S. C. G. Watkins.
New Orleans Odontological Society—Geo. J. Friedrichs.
New York Odontological Society—Wm. Jarvie, Jr., Benjamin Lord.
Odontological Society of Pennsylvania—H. K. Leech.
Pennsylvania Association of Dental Surgeons—E. H. Neall, W. F. Litch.

On motion, adjourned till 8 P. M.

FIRST DAY—EVENING SESSION.

The Association was called to order by President Peirce at 8.20 P. M.

The minutes of the morning session were read and approved.

The Executive Committee reported that they had filled vacancies in their committee as follows:

Section 1. L. D. Shepard. Section 3. F. H. Rehwinkel and H. A. Smith.

The consideration of the reports of Sections being in order, Section III. was called. The chairman, Dr. Atkinson, said "The report we have prepared is a continuation of the former reports, and I would ask the privilege of having Professor Stephen Pearl Andrews read it, as it is in his handwriting and principally his work."

The request was complied with, and Professor Andrews read the report.

On motion of Dr. Abbott the discussion of the report was postponed until the arrival of Dr. Taft.

Section IV. being called, Dr. Webb made a brief report, as follows:

Section IV. recommends the reading of a paper on Operative Dentistry, by Dr. Friedrichs, and the following subjects for discussion:—Root Filling; Alveolar Abscess,—how best treated; Arterial Nævus,—how treated; Styptics in Dental Practice; The Mallet, a Dangerous Instrument in the Process of Filling Teeth; and Artificial Crowns.

The first subject under the report being "Root Filling," was then taken up and discussed by Drs. Atkinson and Wetherbee,—

When the rules were suspended, and it was voted to make the special order for Thursday evening, the selection of the place of the next meeting and the election of officers.

The regular order being resumed, the discussion on "Root Filling" was continued by Drs. Atkinson, McKellops, Barrett, Brophy, and Waters.

On motion, adjourned till 9 o'clock, A.M., to-morrow.

SECOND DAY—MORNING SESSION.

The Association met at 9.30 A.M., President Peirce in the Chair.

The minutes of the last evening session were read and approved.

There being no miscellaneous business, the regular order of consideration of reports of Sections was resumed, and a paper was read on Cylinder Fillings, by Dr. Friedrichs; at the conclusion of which the President called Section III. in accordance with the motion passed last evening "to postpone discussion of the subjects of this Section until the arrival of Dr. Taft."

Dr. Taft having no report, the subject of "Nomenclature and Terminology" was discussed by Drs. Atkinson and Waters and Mr. Stephen Pearl Andrews.

The subject of Operative Dentistry being resumed, was discussed by Drs. Mills, Litch, Niles, Meriam, Webb, Shumway, Beck, Barker, of Providence, La Roche, Andrews, Crouse, and S. B. Palmer, of Syracuse.

The Committee on Credentials made a supplemental report.

Adjourned till 2 P.M.

SECOND DAY—AFTERNOON SESSION.

The Association met at 2.30 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the morning session were read and approved.

Miscellaneous business being in order, on motion of Dr. Crouse, the President's address was referred to the Sections on Education and Etiology.

Dr. McNaughton, Chairman of the Committee on Directory, made a report, which was accepted. It was moved that the report be adopted.

On motion, the whole subject was laid upon the table.

On motion, the subject of Operative Dentistry was passed.

Section V. being called, the report stating the papers to be submitted was read.

A paper on "Reflex Action and Shock in the Dental Specialty," by Dr. Niles, of Boston, was then read, also one by Dr. Bödecker, on Dental Histology. A verbal report on Dental Caries was made by Dr. Abbott, and a paper was read by Dr. Davenport, of Williamstown, Mass., on "Chemical Abrasion of the Front Teeth."

Adjourned to 8 P.M.

SECOND DAY—EVENING SESSION.

The Association met at 8.30 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the afternoon session were read and approved.

The Executive Committee reported that they had examined the Treasurer's account and found it correct.

The following resolution was adopted:

Resolved, That the Treasurer is hereby instructed to pay all properly authenticated orders drawn against him by the officers of this Association.

The regular order being resumed, the consideration of subjects in Section V. was continued.

Dr. Barrett made some remarks on Anesthesia, with questions by Drs. Buckingham and Meigs, of New York.

The Committee on Volunteer Papers made a report, recommending that the paper by Prof. Buchanan be *not* read, unless there should be time at the close of the sessions.

The report was accepted and adopted.

On motion, it was decided to discuss the subjects presented by Section V. in the order in which they had been presented.

Dr. Niles's paper was discussed by Drs. Bödecker, Atkinson, Barrett, and Buckingham.

Dr. Abbott's address was discussed by Dr. Buckingham.

On motion, adjourned till to-morrow morning at 9 o'clock.

THIRD DAY—MORNING SESSION.

The Association was called to order at 9.30 A.M., the President, Dr. Peirce, in the Chair.

The minutes of the evening session were read and approved.

The Committee on Credentials made a further supplementary report.

On motion, the Association decided to accept the proposition to be photographed at 12.30, after adjournment.

The regular order being resumed, the discussion of Dr. Abbott's address was continued by Drs. Bödecker, Buckingham, Niles, Abbott, Chandler, Mills, Crouse, Atkinson, Waters, Brophy, Moore, Peirce, and Taft.

On motion, the subject was passed.

On motion, adjourned till 2 P.M.

THIRD DAY—AFTERNOON SESSION.

The Association met at 2.30 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the morning session were read and approved.

On motion of Dr. Abbott, the President appointed the following committee to draft resolutions regarding the attempted assassination of the President of the United States: Drs. Frank Abbott, W. F. Litch, and Geo. J. Friedrichs.

The Auditing Committee reported that they had examined the financial report of the Publication Committee and found it correct.

The report was accepted and adopted.

The report of the Auditing Committee made yesterday regarding the Treasurer's report was also accepted and adopted.

Dr. Atkinson moved that half an hour be set apart to-morrow at 9 A.M. to enable Prof. Buchanan to read such part of his paper as he may be able to read in that time. Carried.

The regular order being resumed, Dr. Davenport's paper on Abrasion was discussed by Drs. Chandler, Atkinson, Barrett, Litch, Cushing, Fundenburg, Brockway, and Waters.

On motion, the subject was passed.

Anesthesia was then discussed by Drs. Litch, Barrett, Atkinson, and Buckingham.

On motion, the subject was passed.

Section VI. being called, the chairman, Dr. Odell, stated that there was no report ready.

Section I. was called, and the chairman, Dr. Stockton, made a brief report, which was followed by a paper by Dr. John Allen, one by Dr. Grant, of Boston, and one by Dr. E. M. Flagg, of New York.

The following resolution offered by Dr. Mills and seconded by Dr. Atkinson was then adopted:

Resolved, That in consideration of the fact that the officers of the United States Army are about making an effort by concerted action to secure the appointment of competent dentists to the different army posts, we therefore pledge ourselves to give all the aid and co-operation in our power to bring about so desirable a result.

On motion, adjourned to meet at 8 P.M. this evening.

THIRD DAY—EVENING SESSION.

The Association was called to order at 8 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the afternoon session were read and approved.

The following offered by Dr. Waters was passed:

WHEREAS, A petition has been presented to Congress asking for the calling of an international congress to consider and agree upon standard methods of testing visual acuteness and color-blindness, and standard requirements of these necessary qualifications in the navies and merchant marine,

Resolved, That the American Dental Association heartily approves of the proposed international commission, and hereby directs the Secretary of the Association to transmit this expression of our views to Congress when next assembled.

The Committee on Credentials made a supplemental report.

Dr. Geo. L. Field, of Detroit, proposed that Dr. E. Pierrepont, of London, England, be made an honorary member.

Dr. Taft moved that the matter be referred to a committee of three, to report to the Association to-morrow morning. Carried, and the chair appointed as that committee Drs. Taft, Shepard, and Rehwinkel.

The committee appointed to draft resolutions regarding the attempt to assassinate President Garfield made the following report, which was unanimously adopted by a rising vote:

Resolved, That we sympathize profoundly with President James A. Garfield and his family in their present affliction.

Resolved, That we are utterly lacking in language sufficiently forcible to express our abhorrence of the attempt at his assassination and of its author.

Resolved, That it is our fervent prayer, that in President Garfield we may continue to have a living example of a noble man bravely bearing up under difficulties.

FRANK ABBOTT,
GEO. J. FRIEDRICHS,
WILBUR F. LITCH.

The special order for the evening being now called, the balloting for the place of next meeting was proceeded with, resulting in the choice of Cincinnati.

The election of officers resulted in the choice of

President—H. A. Smith, of Cincinnati.
First Vice-President—W. C. Barrett, of Buffalo.
Second Vice-President—Geo. J. Friedrichs, of New Orleans.
Recording Secretary—Geo. H. Cushing, of Chicago.
Corresponding Secretary—A. M. Dudley, of Salem, Mass.
Treasurer—Wm. H. Goddard, of Louisville.
Executive Committee—C. N. Peirce, F. H. Rehwinkel, F. M. Odell.

On motion of Dr. Goddard, the Publication Committee was instructed to have printed five hundred copies of the Amended Constitution and Code of Ethics.

On motion, adjourned to meet at 9 o'clock to-morrow morning.

FOURTH DAY—MORNING SESSION.

The Association was called to order at 9.15 A.M., the President, Dr. Peirce in the chair.

The minutes of last evening's session were read and approved.

In accordance with the resolution passed yesterday Dr. Buchanan was now given half an hour in which to explain his views.

The regular order being resumed, and the chairman of Section I. being absent, this Section was temporarily passed.

Section II. was then called. There was no report from the Section, but papers were presented by Drs. Atkinson, Fillebrown, and Brophy. In the absence of Dr. Fillebrown his paper was read by Dr. Brown.

The subject was discussed by Drs. Litch, Shepard, Odell, Jno. Allen, and Stockton.

The rules were here suspended to enable the Sections to organize, with the following result:

SECTION I. Artificial Dentistry, Chemistry, and Metallurgy.—C. S. Stockton, Chairman; W. H. Fundenberg, L. L. Buckland, T. L. Buckingham, C. C. Carroll, C. W. Clement, W. P. Church, J. O. Cook, Eben M. Flagg, G. F. Grant, Geo. A. Gerry, D. G. Harrington, J. L. Hill, E. Housinger, E. S. Holmes, F. A. Hunter, W. Storer How, F. N. Seabury, E. D. Swain, J. A. Swasey, E. S. Talbot, A. W. Tenney, J. A. Watling, C. A. Woodward, J. C. Whinery, Geo. H. Wilson, D. F. Whitten.

SECTION II. Dental Education.—J. N. Crouse, Chairman; T. W. Brophy, Secretary; W. W. Allport, W. H. Morgan, C. N. Peirce, Thos. Fillebrown, C. J. Essig, Jno. M. Hurtt, W. H. Jones, Chas. D. Cook, T. H. Chandler, Henry Cowie, M. L. Chaim, A. Colton, W. H. Colgrove, L. D. Shepard, J. H. Smith, G. Carleton Brown, John Allen, G. W. Klump, L. C. Bryan, K. B. Davis, C. E. Francis, Isaiah Forbes, O. F. Harris, J. S. Hurlbut, C. S. Hurlbut, D. B. Ingalls, H. H. Jackson, C. A. Kingsbury, C. A. Kitchen, Joseph Lathrop, W. N. Morrison, D. C. McNaughton, J. S. McCampbell, A. L. Northrop, C. H. Osgood, A. L. Pettee, S. G. Stevens, C. W. Spalding, S. D. Stewart, J. G. Templeton, C. P. Wilson, Geo. A. Young.

SECTION III. Dental Literature and Nomenclature.—W. H. Atkinson, Chairman; J. Taft, Secretary; M. V. Toledo, W. A. Bronson, D. S. Dickerman, W. C. Dyer, S. W. Dennis, I. Douglass, J. N. Davenport, P. K. Filbert, M. F. Finley, Wm. Jarvie, Jr., Saml. E. Knowles, D. C. Kelly, Geo. A. Mills, D. D. Smith.

SECTION IV. Operative Dentistry.—E. T. Darby, Chairman; H. J. McKellops, Secretary; W. C. Starbuck, C. W. Partridge, J. B. Coolidge, G. R. Thomas, J. W. Rhone, M. H. Webb, J. N. Farrar, Wm. T. La Roche, Benj. Lord, J. G. W. Werner, H. A. Smith, Dwight M. Clapp, W. E. Page, S. B. Palmer, S. C. G. Watkins, Jas. McManus, Jas. G. Palmer, Geo. B. McDonald, Wm. Dutch, Wm. H. Allen, G. W. Hoysradt, H. C. Meriam, J. F. Canine, I. J. Wetherbee, A. N. Priest, W. H. Goddard, M. H. Dodge, Geo. W. Keely, R. R. Andrews,

Seneca B. Brown, Joseph Bauer, Wm. Barker, C. R. Butler, A. H. Brockway, A. W. Buckland, H. F. Bishop, J. E. Blake, C. Bullock, G. C. Daboll, A. F. Emminger, Geo. L. Field, S. H. Guilford, E. S. Gaylord, W. P. Leavitt, J. U. Lee, G. S. Meigs, T. T. Moore, C. A. Marvin, S. G. Perry.

SECTION V. Anatomy, Histology, and Microscopy.—M. S. Dean, Chairman; M. L. Rhein, Geo. H. Cushing, G. F. Waters, Frank Abbott, C. F. W. Bödecker, G. V. Black, Chas. Merritt, J. F. Marriner, Henry W. Morgan, H. Eugene Smith.

SECTION VI. Pathology, Therapeutics, and Materia Medica.—Frank M. Odell, Chairman; A. M. Dudley, Secretary; A. W. Harlan, E. B. Davis, L. C. Ingersoll, Wilbur F. Litch, C. A. Brackett, C. S. Beck, C. T. Stockwell, Geo. J. Friedrichs, J. P. Wilson, E. A. Bogue, F. H. Rehwinkel, T. C. Stellwagen, Wm. Taft.

SECTION VII. Physiology and Etiology.—W. C. Barrett, Chairman; Leon Ridcout, E. S. Niles, E. Hunter, J. A. Bishop, H. A. Baker, R. W. Brown, I. B. Davenport, S. E. Davenport, A. W. Freeman, S. A. Freeman, D. C. Hawxhurst, C. W. Meloney, H. B. Noble.

[Members who have connected themselves, or have been assigned to certain Sections, are at perfect liberty to present their views on any subject, in papers to be referred to the appropriate Section.—SEC'Y.]

The regular order being resumed, the discussion on Education was continued by Drs. Brophy, Hunter, Shepard, Butler, Litch, Atkinson, Abbott, and Buckingham.

On motion the subject was passed.

The time of adjournment was extended, in order that the business might be completed, and the Association adjourn *sine die.*

The following offered by Dr. Crouse were adopted:

Resolved, That hereafter, no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, That when it comes to the knowledge of the Committee on Credentials, that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are; and in no case shall this Association be compelled to treat with violations of the Code of Ethics, except when the violator is a member of this body, and has no membership in any local society.

On motion, it was agreed to call the Sections to order immediately after adjournment.

On motion, the President appointed Drs. Buckingham and Wetherbee to conduct the newly-elected President to the Chair, who was briefly introduced.

The Publication Committee were instructed to use their discretion in the matter of printing the Transactions, as last year.

The regular order being resumed, Section I. was called and passed.

On motion of Dr. Buckingham, the thanks of the Association were tendered to the Local Committee of Arrangements for the courtesies extended by them.

Dr. Crouse moved a vote of thanks to the retiring officers, and to the press reporters, which was carried.

On motion of Dr. Atkinson, a vote of thanks was extended to Dr. Buchanan for his remarks this morning.

A vote of thanks was passed to the proprietors of the Westminster Hotel, for the reduced rates they offered, and for the very acceptable manner of our entertainment.

The President appointed as members of the Publication Committee, Drs. Dean and Darby, and as Local Committee of Arrangements, Drs. J. Taft, Geo. W. Keely, and C. R. Butler.

The following notice of amendment to the Constitution was filed by Dr. Shepard:

To amend Article IV., of the Constitution, so as to make the present article Section 1, and to add a section as follows:

Sec. 2. The officers may, for extraordinary reasons, change the time and place of meeting upon the written consent of (10) of the fifteen (15) officers.

The minutes were read and approved, and the Association adjourned to meet in Cincinnati on the first Tuesday in August, 1882.

Geo. H. Cushing, *Secretary.*

Amended Constitution,

Adopted at Saratoga, August, 1869, with Amendments up to and including the Session of 1882.

ARTICLE I.

Name.—This organization shall be known by the name of the American Dental Association.

ARTICLE II.

Objects.—The objects of this Association shall be to cultivate the science and art of Dentistry, and all its collateral branches; to elevate and sustain the professional character of Dentists, to promote among them mutual improvement, social intercourse, and good feeling, and collectively to represent and have cognizance of the common interests of the Dental Profession.

ARTICLE III.

Section 1.—Membership; Number of Delegates from Local Societies.—Each local society may send one for every five of its active members, and each Dental College one from its faculty as delegates to this Association for one year, upon complying with the requirements of its Constitution; but no society shall be entitled to representation that does not adopt or substantially recognize its Code of Ethics.

Sec. 2.—Expelled Members.—Any member of this Association being expelled or suspended from his local society, shall from that date cease to be a member of this body. [Amended 1880.]

Sec. 3.—Members to be of Three Classes.—The members of this Association shall be of three classes, viz: Delegates, permanent, and honorary members; the two former classes having equal rights and privileges, except eligibility to office and membership of the Sections —none being eligible to hold office except permanent members; the

latter class to consist of prominent, worthy members of the dental profession residing in foreign countries, who shall be elected by ballot.

SEC. 4.—DELEGATES.—All delegates shall be practitioners of Dentistry; they shall receive their appointment only from permanently organized Dental Societies and Dental Colleges, having definite conditions of membership other than pecuniary, which shall have been approved by the Executive Committee, and a copy of which shall be in the hands of the Recording Secretary of this body.

This Association will hereafter receive no delegate, who shall after this date, [August, 1875,] enter the profession without first having graduated at some reputable dental or medical college.

SEC. 5.—PERMANENT MEMBERS.—Permanent members shall consist of those who having served one year as delegates, and complied with the requirements of the Association, shall signify to the Treasurer a desire for permanent membership. After the resignation of a member has been accepted, the Association may at any time thereafter reinstate such member by unanimous consent. [Amended 1881.]

SEC. 6.—SIGNING CONSTITUTION.—Each new member, before voting or speaking on any subject before the meeting, shall sign these regulations, inscribing his name and the title and location of the institution from which he receives his appointment.

SEC. 7.—DUES.—Five dollars shall be paid to the Treasurer by each member yearly, as dues, before he can be eligible to office, or speak or vote on any subject before the Association; and in case the dues remain unpaid at the close of the second annual meeting thereafter, the name of any such delinquent shall be erased from the list of members without further action.

SEC. 8.—GIVING NAME ON RISING.—No one shall be permitted to address the Association before giving his name and residence, which shall be distinctly announced from the Chair; nor shall he speak more than twice, nor longer than fifteen minutes in all, unless by consent of the Association.

SEC. 9.—CONDUCT OF MEMBERS.—Any act of special immorality or unprofessional conduct committed by a member of this Association shall be referred to the Executive Committee (second division),

whose duty it shall be to thoroughly examine into the case, and report at the next meeting if the charges be sustained. Whereupon, by a vote, the offending member may be reprimanded or expelled, a two-thirds vote being required for expulsion, a majority being sufficient for reprimand.

ARTICLE IV.

Time of Meetings.—The regular meetings of the Association shall be held annually, and commence on the first Tuesday in August. The place of meeting shall be determined each year by vote of the Association. After the selection of a place of meeting there shall be appointed by the President, annually, a committee of three, residing at or near the place selected for the next meeting, whose duty it shall be to procure rooms for meetings, clinics, and for the exhibition of mechanical appliances, and to make such other local arrangements as may be needed for the Association. This committee shall act under the direction of the first Division of the Executive Committee.

[Sec. 2.—The officers may, for extraordinary reasons change the time and place of meeting upon the written consent of ten (10) of the fifteen (15) officers.

☞The above amendment offered at the session of 1881 is here inserted, as it will undoubtedly become a law at the session of 1882.—Pub. Com.]

ARTICLE V.

Section 1.—Officers: how Elected.—The officers of this Association shall be a President, two Vice-Presidents, Corresponding Secretary, Recording Secretary, Treasurer, and the Executive Committee, who shall be elected by ballot without nomination. The three names, or in case of a tie, the four names having the greatest number of votes shall be the sole nominees in case of failure to elect on the first ballot, and a majority of all the votes cast for those names shall be necessary to a choice.

Each officer, except as otherwise provided, shall hold his appointment for one year, or until another is elected to succeed him.

Sec. 2.—President: Duties of.—The President shall preside according to parliamentary usage, as laid down in "Cushing's Manual," and the rules of order adopted by this Association.

Sec. 3.—Vice-Presidents.—In the absence of the President, one

of the Vice-Presidents shall perform the duties of the office, and in the absence of these officers a Chairman *pro tem.* shall be appointed by acclamation.

SEC. 4.—CORRESPONDING SECRETARY.—The Corresponding Secretary shall attend to the correspondence of the Association with the societies therein represented, and to correspondence with other scientific bodies as may be desirable.

SEC. 5.—RECORDING SECRETARY.—The Recording Secretary shall keep accurate minutes of the proceedings of the Association, preserve the archives and unpublished documents, and attend to the other duties that pertain to his office. He shall be *ex-officio* chairman of the Publication Committee, and shall see that due notice is given of the time and place of meeting of the Association.

SEC. 6.—EXECUTIVE COMMITTEE.—The Executive Committee shall be the business committee of the Association, and shall consist of nine members, to whom shall be referred all business not otherwise specially provided for. They shall report at each meeting under the proper head their doings for the current year.

SUB-COMMITTEES.—FIRST DIVISION: COMMITTEE OF ARRANGEMENTS.—Three members of this committee shall act as the Committee of Arrangements, and shall procure suitable accommodations for the meetings and clinics, and for the exhibition and examination of appliances, of which they shall have the charge. These three shall attend generally to the wants of the Association during its session.

SECOND DIVISION: CREDENTIALS AND AUDITING COMMITTEE.—Other three shall examine and verify the credentials and qualifications of members, including all violations of the Code of Ethics and the Constitution, and shall also be the Auditing Committee for that year.

THIRD DIVISION: COMMITTEE ON VOLUNTEER ESSAYS.—The remaining three shall examine all volunteer essays, and before they are read to the Association shall give their approval, in order that time may not be taken up by unworthy or irrelevant matter.

They shall report the names of places for the next meeting.

PUBLICATION COMMITTEE: HOW APPOINTED.—The President shall

appoint two members of this Association, who shall act in conjunction with the Recording Secretary as the Publication Committee. They shall be authorized to employ a competent reporter to furnish an accurate report of the proceedings of each meeting.

Instructions to the Publication Committee.—They shall superintend the publication and distribution of such portions of the Transactions as the Association may direct, or the committee judge to be of sufficient value. They shall specify in the annual report of this committee the character and cost of the publications of the Association during the year, and the number of copies still on hand. Any report or other paper to be entitled to publication in the volume of the Transactions for the year in which it shall be presented to the Association must be placed in the hands of the Publication Committee on or before the first day of September, and must also be so prepared that the proof-sheets furnished the authors shall be returned to the committee without material alteration or addition.

Every paper received by this Association and all plates or other means of illustration shall be considered the exclusive property of the Association, and shall be published for its benefit. [Amended 1880.]

Disclaimer.—This committee is hereby instructed to print at the beginning of each volume of the Transactions the following disclaimer, viz.: "The American Dental Association, although formally accepting and publishing the reports of the various Standing Committees, and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution."

Reports of Sub-Committees.—Each of these sub-committees shall report from time to time, as may be necessary, to the Executive Committee as a whole, who shall decide upon such report if possible; but in case of their inability to decide upon any matter, it shall be brought before the Association for its decision as early as practicable.

Classification of Executive Committee.—At the first election of this committee, the first three shall be elected to serve three years, the second three for two years, and the last three for one year, and thenceforward three new members shall be elected each year by ballot, to serve three years, and in case of the absence of

any member of this committee his place may be temporarily filled by the remaining members of the committee.

MEETINGS OF EXECUTIVE COMMITTEE.—The Executive Committee shall, if possible, meet for consultation and arrangement of their respective duties on the day preceding the annual meeting of the Association, and shall meet for the examination of credentials, the arrangement of appliances, and the reception of papers, and such other business as may properly come before them at 8 A. M. on the day of the annual meeting.

SUBDIVISION OF EXECUTIVE COMMITTEE.—They shall also meet after the election of new members to the committee to choose their own chairman and secretary, and to divide themselves into subcommittees as hereinbefore provided, and for the purposes described.

CHAIRMAN MAY CONVENE THE COMMITTEE.—The chairman of this committee may at his own discretion summon the members thereof to a meeting at any suitable hour during the sessions of the Association.

SEC. 7.—TREASURER TO ATTEND, TO RECEIVE DUES AT 8 A. M.—The Treasurer shall hold all the moneys belonging to the Association, and shall keep an accurate account as between the society and its members. He shall attend the meeting of the Executive Committee at 8 A. M. on the day of the annual meeting to receive dues, and shall attend at roll-call to verify the list of names, checking all such as are in arrears for dues; he shall restore such names upon payment of dues within the legal limits, and shall notify all whose names may be erased from the list of membership. He shall pay the drafts of the President, countersigned by the Secretary, upon vote of the society only, and shall report to the Executive Committee, where his accounts shall be audited, and by whom his report shall be presented to the Association, together with their own.

ARTICLE VI.

SECTION 1.—To prepare, arrange, and expedite business, this Association shall be divided into seven Sections, as follows:

1. Artificial Dentistry, Metallurgy, and Chemistry.
2. Dental Education,
3. Dental Literature and Nomenclature.

4. Operative Dentistry.
5. Anatomy, Histology, and Microscopy.
6. Pathology, Therapeutics, and Materia Medica.
7. Physiology and Etiology. [Amended 1881.]

SEC. 2.—It shall be the duty of each permanent member to inform the Recording Secretary before the close of the morning session of the third day of the Annual Meeting, which of the seven Sections he elects to join for the ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one Section during the same year.

[But he may present volunteer papers to any of the other Sections.—SEC'Y.]

SEC. 3.—It shall be the duty of the Recording Secretary immediately after the close of the above morning session of the third day, to make out lists of the names thus furnished of each Section, as a basis for the election of officers of said Sections.

SEC. 4.—The Association shall, by vote, assign some time after the regular election of officers of the Association for the meeting of the several Sections for organization.

SEC. 5.—When the time for the organization of the Sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each Section with the list of members of his respective Section, which member shall thereupon call the members to order and read the list of names. The members shall then elect by ballot a chairman and such other officers as they may see fit.

SEC. 6.—The chairman shall preside at all the meetings of his Section; shall exercise general supervision over the business, and shall see that the labors of his Section are conducted in the manner calculated to secure the best results. The chairman, or such other member or members as the Section shall select, shall prepare and read at the annual meeting of the Association next ensuing a paper or papers on the advances and discoveries of the past year in the branches included in the Section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7.—The several Sections shall meet at 10 A.M. on the morning of the first day of the annual meeting of the Association.

SEC. 8.—For the information of all members, a list of the members of each Section shall be published in the Transactions of each year.

ARTICLE VII.

QUORUM.—Fifteen members shall constitute a quorum for the transaction of business in this Association.

ARTICLE VIII.

SUSPENDING RULES: THREE-FOURTHS TO VOTE.—This order of business may be temporarily suspended by a three-fourths vote of all the members present, for the consideration of a specific subject, upon the completion of which the regular order shall be at once resumed.

RULES OF ORDER.

1. On the arrival of the hour of meeting, the President shall take the chair, call to order, and announce that the meeting is open for business.

2. No motion or speech shall be in order until the mover or speaker shall have been recognized and assigned the floor by the Chair, nor shall a motion be open for debate until seconded and stated by the Chair.

3. At the request of any member a motion shall be put in writing.

4. At the request of five members a question shall be divided, or the yeas and nays ordered.

5. When a question is under debate, no other motion shall be in order, except—1st, to adjourn; 2d, to lay on the table; 3d, the previous question; 4th, to postpone; 5th, to commit; 6th, to amend; and these motions shall take precedence in the order here stated.

6. The previous question, and the motions to adjourn, to lay on the table, and to postpone, shall be decided without debate.

7. A motion to adjourn shall always be in order, but no member can make such a motion while another is speaking, or while a vote or ballot is being taken.

8. A second amendment to the main question shall not be in order until the first is disposed of, nor shall there be an amendment of an amendment to an amendment.

9. After a motion has been seconded and stated by the Chair, it shall not be withdrawn without the consent of the Society.

10. No member shall interrupt another while speaking, except to call him to order.

11. When called to order, a member shall sit down until the point of order is decided by the Chair, or, in case of appeal, by the Society. If the point of order be sustained, the member can proceed in order by the consent of the Society.

12. Every member shall vote upon a question unless excused by the Society.

13. When any motion, except to adjourn, has been rejected, it shall not be renewed without unanimous consent.

14. Any member who voted in the majority may move a reconsideration of that question, but if that motion shall be lost or laid upon the table, it shall not be renewed without unanimous consent.

15. The President may vote with the members upon all questions, but having so voted, shall not give the casting vote in case of a tie.

16. Motions for filling blanks shall be put in the order in which they are moved.

17. On a division, or in voting by yeas and nays, any member may change his vote before the result is declared.

18. These rules may be suspended by unanimous consent.

ORDER OF BUSINESS.

1. Meeting of the Executive Committee, filling of vacancies therein, examination of credentials, and payment of dues, 8 A.M.

2. Meetings of the Sections at 10 A.M.

3. Organization of the Association at 11 A.M.

4. Calling the roll of qualified members.

5. Reading of the minutes and action thereon.

6. The reading and consideration of the stated annual reports from the Sections, together with volunteer papers upon the same subjects in their consecutive order.

7. Report of Executive Committee.

8. Balloting for the place of next annual meeting.

9. Election of officers and three members of Executive Committee.

10. Instructions to the permanent committees.

11. Unfinished, new, and miscellaneous business.

12. Adjournment.

AMENDMENTS.

Alterations and amendments may be made in the foregoing Articles or Rules of Order at any annual meeting, by the consent of all the members present. Otherwise notification in writing shall be made of any such proposed alterations or amendments, and laid over for one year for final action, when they can only be adopted by an affirmative vote of two-thirds of the members present.

STANDING RESOLUTIONS.

The following standing resolutions are in force at this time, August 1, 1882.

Resolved, That henceforth no person shall be received as a delegate who is in arrears for dues, or until he has paid to the Treasurer the full amount due at the time his name was dropped for non-payment.

Adopted August, 1874.

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Adopted August, 1879.

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Adopted August, 1880.

Resolved, That hereafter no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, When it comes to the knowledge of the Committee on Credentials that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are, and in no case shall this Association be compelled to treat with violations of the Code, except where the violator is a member of this body and has no membership in any local society.

Adopted 1881.

Resolved, That the Secretary be instructed to assign members who may neglect to make their own choice the Section in which they are expected to work.

Adopted 1879.

Resolved, That the reports of Sections shall be called by the President in consecutive order, beginning each succeeding year one number higher than on the preceding year.

1879	commencing	with	No. I.
1880	"	"	No. II.
1881	"	"	No. III.
1882	"	"	No. IV.
1883	"	"	No. V.
1884	"	"	No. VI.
1885	"	"	No. VII.
1886	"	"	No. I.

Adopted 1879.

CODE OF DENTAL ETHICS.*

ARTICLE I.

THE DUTIES OF THE PROFESSION TO THEIR PATIENTS.

SECTION 1.—The dentist should be ever ready to respond to the wants of his patrons, and should fully recognize the obligations involved in the discharge of his duties toward them. As they are, in most cases, unable to correctly estimate the character of his operations, his own sense of right must guarantee faithfulness in their performance. His manner should be firm, yet kind and sympathizing, so as to gain the respect and confidence of his patients; and even the simplest case committed to his care should receive that attention which is due to any operation performed on living, sensitive tissue.

SEC. 2.—It is not to be expected that the patient will possess a very extended or a very accurate knowledge of professional matters. The dentist should make due allowance for this, patiently explaining many things which may seem quite clear to himself, thus endeavoring to educate the public mind so that it will properly appreciate the beneficent efforts of our profession. He should encourage no false hopes by promising success where, in the nature of the case, there is uncertainty.

SEC. 3.—The dentist should be temperate in all things, keeping both mind and body in the best possible health, that his patients may have the benefit of that clearness of judgment and skill which is their right.

ARTICLE II.

MAINTAINING PROFESSIONAL CHARACTER.

SECTION 1.—A member of the dental profession is bound to maintain its honor, and to labor earnestly to extend its sphere of usefulness. He should avoid everything in language and conduct calculated to discredit or dishonor his profession, and should ever manifest a due respect for his brethren. The young should show special respect to their seniors; the aged special encouragement to their juniors.

* Adopted August, 1866.

SEC. 2.—The person and office arrangements of the dentist should indicate that he is a gentleman; and he should sustain a high-toned moral character.

SEC. 3.—It is unprofessional to resort to public advertisements, such as cards, hand-bills, posters, or signs calling attention to peculiar styles of work, prices for services, special modes of operating, or to claim superiority over neighboring practitioners; to publish reports of cases, or certificates in the public prints; to go from house to house soliciting or performing operations; to circulate or recommend nostrums, or to perform any other similar acts. But nothing in this section shall be so construed as to imply that it is unprofessional for dentists to announce in the public prints, or by card, simply their names, occupation, and place of business; or in the same manner, to announce their removal, absence from, or return to business; or to issue, to their patients, appointment cards having a fee bill for professional services thereon.

SEC. 4.—When consulted by the patient of another practitioner the dentist should guard against inquiries or hints disparaging to the family dentist, or calculated to weaken the patient's confidence in him; and, if the interests of the patient will not be endangered thereby, the case should be temporarily treated, and referred back to the family dentist.

SEC. 5.—When general rules shall have been adopted by members of the profession practicing in the same localities, in relation to fees, it is unprofessional and dishonorable to depart from these rules, except when variation of circumstances requires it. And it is ever to be regarded as unprofessional to warrant operations or work as an inducement to patronage.

ARTICLE III.

THE RELATIVE DUTIES OF DENTISTS AND PHYSICIANS.

Dental surgery is a specialty in medical science. Physicians and dentists should both bear this in mind. The dentist is professionally limited to diseases of the dental organs and the mouth. With these he should be more familiar than the general practitioner is expected to be; and while he recognizes the superiority of the physician in regard to diseases of the general system, the latter is under equal obligations to respect his higher attainments in his specialty. Where this principle governs, there can be no conflict, or even diversity, of professional interests.

ARTICLE IV.

THE MUTUAL DUTIES OF THE PROFESSION AND THE PUBLIC.

Dentists are frequent witnesses, and at the same time the best judges, of the impositions perpetrated by quacks, and it is their duty to enlighten and warn the public in regard to them. For this and the many other benefits conferred by the competent and honorable dentist, the profession is entitled to the confidence and respect of the public, who should always discriminate in favor of the true man of science and integrity, and against the empiric and impostor. The public has no right to tax the time and talents of the profession in examinations, prescriptions, or in any way, without proper remuneration.

Annual Address.

By C. N. PEIRCE, President.

Gentlemen of the American Dental Association:

We have met this year under unusual conditions, our Association having been convened almost a month earlier than has been customary, in order that those of its members who wish may have the opportunity of accepting an invitation to attend an International Medical Congress meeting in London, without absenting themselves from this our annual gathering. While this invitation to the dental profession in America indicates a change in the estimate of the American dentist, and should therefore be received with a degree of satisfaction and pleasure, yet considered in connection with similar advances at home, it should cause anxiety as to the possible influence which it may have upon the future of our profession. Casting a retrospective glance to a period not far distant, and from thence following step by step each progressive effort, noting the obstacles that have been overcome, and the successive positions attained, each giving a broader view and opening up a wider field of labor and thought, we cannot fail to see that during this period there has been no more persistently indifferent and unappreciative class than those who now invite us to share in their deliberations. These overtures on the part of the medical profession are certainly gratifying, so far as they indicate that the dental profession has gained a definite position in the ranks of the healing art.

That we can meet with the medical profession to our and their advantage I firmly believe. But to be thus profitable the meeting must not depend on titles and degrees purchased or conferred, but must result from an appreciation of knowledge acquired by industrious, persevering, and original research. Titles and degrees conferred until the alphabet is exhausted are but as stones to the neck of a drowning man, or as voluminous and eulogistic epitaphs upon the gravestone of a criminal; the one excites derision and disgust, the other is a serious obstacle in the way of life. The late movement on the part of some of the medical schools in instituting additional chairs for the purpose of giving instruction in dentistry, would be entitled to more

confidence and favor had the medical profession shown any appreciation of the requirements of the dentist; of the field for study which dentistry offers; of the fact that the organs and adjacent tissues with which we have to deal possess anatomical and physiological connections, liable to a wide range of pathological sympathies and complications; that even in the microscopic tooth-germs are wrapped up inherited physical, mental, and moral peculiarities; that in no organs or tissues more than in the teeth is there a greater tendency to reproduce parental characteristics; in none are imperfections in structure and predispositions to disease more certainly transmitted; in none are systemic conditions more readily impressed, and that for the observation of these physiological and pathological peculiarities no occupation affords a better opportunity than that of the dentist.

That the medical profession has never appreciated and does not now appreciate the requirements of the dentist is made patent by the fact that upon a partial and very limited medical education, its colleges are yearly conferring degrees in dentistry with all of the rights and privileges pertaining thereto, while the ophthalmologist, dermatologist, obstetrician, and gynæcologist, as well as the aural surgeon, must all take a full course of medicine and receive the degree of M. D. before they can be recognized in any of the above specialties.

Is there in the practice of any one of these specialties sympathetic nervous relations more serious than those accompanying many conditions of the teeth, and especially those occurring during the formative and eruptive period of dentition, a period during which it is an undisputed fact that the greatest number of deaths occur among children?

Twenty annual meetings have been held since this Association was evolved from The American Dental Convention. The pertinent inquiry now is, Have our yearly gatherings been sufficiently fruitful to compensate for the separation?

A brief résumé of our work and growth would, if time permitted, be a matter of interest to the younger members, but we must be content with noting a few evidences of progress.

Our meetings, which were at first largely occupied with papers and discussions on means and methods, with only an occasional paper beyond these limits, are now, in addition to such, treated every year to essays based on original research, indicating methodical study, a wider range of thought, and a higher degree of culture.

The Sections of Anatomy, Physiology, Histology, and Microscopy, of Pathology, Therapeutics, and Materia Medica, of Dental Education and of Dental Literature, have each, as they have in turn been called upon, responded with creditable reports upon these subjects, of especial worth as indicative of future work and attainment.

While we note with pleasure what has been accomplished in the past, there yet remains a large field for investigation and an immensity of work to be done.

Economy of time, greater care in the selection of topics, and the limiting of discussion on unimportant subjects, will greatly facilitate our proceedings and add interest to our sessions. In proof of the necessity for this let me refer to an occurrence or two of last year. In one instance a large portion of one session was consumed in discussing the propriety of reinstating an old member; and in another two full sessions were occupied (the report embracing twenty pages of our printed proceedings) in remarks largely confined to the relative value of adhesive and non-adhesive gold foil, whereas every skillful operator recognizes the fact that equally good and satisfactory work can be done with each; that the results depend more upon the skill and judgment of the operator than on the material used; and also that, however much we may be by education and experience attached to gold, we must admit that there are more teeth saved with what are known as plastic fillings than with gold; that an eclectic practice is to be preferred to one in which an exclusive and hurtful discrimination against any material of value obtains.

Among the subjects of importance to the public as well as to the practicing dentist, there is one that has been almost wholly neglected by the numerous essayists who have contributed to our pleasure and instruction. I refer to that of Etiology—the science of the causes of dental caries. Little has been written and nothing systematized or formulated respecting the all-important factors in the production of the almost universal disease which results in the destruction of tooth-tissue. It is true we constantly allude to caries of the teeth as being due to exciting and predisposing causes. We go further, and with much confidence state that the exciting cause is the presence of a vitiated saliva induced by local and systemic conditions; that the predisposing causes are vices of conformation occasioned by imperfect or improper nutrition during the period of calcification.

These represent a very limited number of the various influences

which are constantly operating against the durability of the teeth. With a more liberal education, and more time to devote to this line of investigation, I trust we shall much more fully appreciate hereditary, physiological, pathological, and dietetic influences.

We may derive valuable information from observations upon the lower animals, especially upon the effects of treatment of domestic animals in changes of food, habits of life, etc.

The relations existing between the mandibular or lower-jaw movements and tooth-forms are not ideal, but real, and are dependent to a great extent upon the mode of use of the parts, and the force exerted. It is also true that those animals which live upon the toughest and most solid food, have the most deeply implanted teeth and the most effective arrangement for the replacement of tooth-structure when lost by wear. In the examination of the jaws and teeth of lower animals we find that with the simplest type of jaw-movement, which is that where the mouth is simply opened and closed in a vertical line without any lateral or horizontal movement, there exists the simplest tooth-form, and that with increasing complexity of the lateral movement, there is an increased complexity of the enamel foldings, ridges, and crests of the tooth-crown.

It is also apparent that incisor teeth are partially or entirely absent in animals which have long prehensile tongues, mobile, prehensile lips or proboscces. It is more than probable that this undue development on the part of these organs, and the disappearance of the dental element, is due to the absence of function on the one part, and to increased function on the part of the soft structures.

"There is then a constant relation between use and strength of the part used, which needs no other explanation than such as will recognize the force excited by the muscles of any animal as a retro-active stimulus evoking development of strength, not only of the muscles, but of the sclerous or hard tissues, whenever needed, and conversely, causing degeneration or retroaction of development in parts not exercised."

The above facts, together with illustrations which may be deduced to sustain them, make it safe to conclude that the almost universal prevalence of dental caries, and many other oral deformities, are in a large measure due to the increasing use of soft foods, and to a want of proper use of the teeth in comminuting harder and drier pabulum, the proper trituration of which would be an active stimulant, tending to produce a healthier and stronger development of tooth-structure. A letter before me from that indefatigable worker, Henry

Bergh, states that exclusive and continuous excessive slop-feeding of cows not only loosens the teeth but causes them to fall out, and tends to inflammation and sloughing of the gums. The experience of every practical dentist cannot fail to make him fully cognizant of the marked difference in the teeth of those who live upon dry, solid food and those subsisting largely on fluids and semi-solids. Visits to the various institutions where the inmates are detained and protected, offer excellent opportunities for the examination of the teeth, and for noting the influence upon them of the warm drinks which soften and wash into the stomach food without mastication.

The increasing care and trouble which the dentist experiences in the successful treatment of a young miss's teeth, while she is preparing for competitive examinations and promotion at school; the exalted sensitiveness of the teeth during the period of gestation and lactation; the almost uniform certainty of the loss of two or more teeth by the average mother for every child nursed,—these and many other conditions with which every dentist of experience must be impressed, speak to the profession in unmistakable language of the inefficiency of all methods based entirely on manipulative skill.

In conclusion I beg leave to offer the suggestion, that the Section embracing Etiology organize a voluntary committee, which shall at once commence a careful and systematic investigation with the view of ascertaining as far as possible the causes which contribute to the almost universal existence of dental caries. I believe it quite possible for this body in a year or two to say to the public that there are certain physical, mental, moral, and dietetic causes which are contributing both directly and indirectly to the prevalence of this condition, which is so destructive of health and beauty.

SECTION III.

Dental Literature and Nomenclature.

Report on Nomenclature and Terminology, by W. H. ATKINSON, Chairman.

FOR our present installment of universological science in its application to histological and anatomical particulars, we cannot do better than recur to the fundamental discrimination of FORM, quoted two years ago, and re-quoted last year. This is as follows:

1. Punctiform.
2. Liniform.
3. Plainiform.
4. Solidiform.

It must now be added that Universology demonstrates that *all classifying discriminations in all spheres of Being* go back, for their origin, to the department of Form (or shapes), and that (particularly for our present purpose) there are, fundamentally, four grand systems of distribution, and consequently of appropriate classification of all the generals, specials, and detailed particulars of the human body, following precisely this fundamental four-fold discrimination of the varieties of form; and as the point, the line, the plane, and the solid rise one above the other, from the point onward, in the order of their increasing complexity, so that order of classification within the body which is developed upon, and which represents the point or punctiform, is the most minute, and is the primitive or elementary one, and is, in fact, therefore, the Histological, or microscopico-anatomical domain; while the remaining three systems rise above, envelop, and, as it were, obscure or conceal it.

In addition to all this, there is the combination, in the totality of the structure, of all these varieties of form in a complicated *mikton*, or admixture of parts, which are partially smelted into a complicated mass, artistically modified or molded into each other—for Nature herself has her artistic (or artismal) department in the final finish of things, as well as her naturismal department in their first crude massing, and her scientismal department in their regular and

schemative outlay. For the artistic blending of parts in the finish of structures, Stephen Pearl Andrews has furnished the expressive and valuable new technicality, COMPLASTICATION (or, if it be preferred as more purely Greek, *symplastication*).

The two side-halves of the entire brain, for instance, were, in the primitive outlay or original ideal of brain-structure, each a complete sphere or globe-shaped body; which spheres being co-aptated, or placed and pressed against each other, became hemi-spheroid, and then by being pressed out in some directions, retracted in others, everted, convoluted, and, as it were, kneaded into the requisite shape for their ultimate uses, the brain, as a whole, results in being spheroid, or proximately a single sphere; the primitive spheres having subsided into hemispheres. This ultimate and complicated modification of form is, in the final shape, an instance of complastication.

From out of the blended mass of the finished structure we have to rescue, as it were, and discover the minute and elementary parts. These are in a general sense the tissues, and the still more primitive corpuscles and fibers. For this department of investigation we resort to the microscope.

As to the objects to be investigated under the microscope, none is so interesting and important as the embryo, the most ready and easy access to which we have in the case of the development of the chick, in the hatching of the common hen's egg. Embryology and histology here meet, and so we are, as it were, at the center of anatomical affairs, and especially as they chiefly concern us professionally. And now come Universology and Alwato to preside over classification and nomenclature, which we must now glance at again, as they affect matters at this fountain-head of biological science.

The Alwato word for the human body is HOBODO. If we add to it the syllable, -BO, which again signifies embodiment (making hobodo, bo), the further addition to this stem-word of certain leading consonant sounds will then denote the several kinds of substance (as tissues, organs, etc.) of which the body is composed. Observe, however, that among these *arrangements* the joints (denoted by P) are included, thus:

Hobodo,bō,ng; cartilage.
Hobodo,bō,n·go (bōng-go); bone.
Hobodo,bō-ndlr,io; sinew.
Hobodo,bō,b,io; muscle, etc. (especially bo,ndr,io for contractility).
Hobodo,bō,v,io; secretory substance.
Hobodo,bō,p,io; joint.
Hobodo,bō,fr,io; nerve.

Add to this the following meanings assigned to the accompanying letters and syllables:

K; cut, division.
M; out.
N; in.
Go; shaft, or trunk-like process.
Do; head, or knob-like object.

In what here remains to be said, we shall have to deal mainly with BŌNG and BŌN·GO (cartilage and bone), and with the added letters and syllables, K, M, N, GO, DO. With these elements we shall effect the following embryonic classification.

Let us, however, combine the first and last members of the foregoing catalogue into the BŌNGF,IO (cartilage-nerve-blood-mass=myxomatous tissue), to denote the primitive mass of organifient materials, behaving somewhat like cartilage and somewhat like nerve-matter (neural mass), out of which the pronounced tissues and organs subsequently emerge. Or, to avoid complication, we may here treat this primal organized mass as cartilage in a primitive state, employing the name BŌNG(IO), tracing its differentiation into bone and the other organic aspects of the incipient being. It is not so much histological precision which is here important, as it is illustration of the new method of naming the discriminated parts, however classified, which Alwato places at our disposal.

The Alwato word for *first* is Çīs(o), pronounced *tshees(o)*; -I,TŌZ (*-ee-tōz*) is a plural diminutive ending; and so BŌNG,I,TŌZ will mean little masses of cartilaginous or cartilage-like (chondroid) matter; and çīs.BŌNG,I,TŌZ will be and is the true naming for the "protovertebræ," "somites," the primitive plates, chondroids, or gristles.

The K-sound denoting CUT or DIVISION, BŌNG,KI,TO (1) is the "primitive trace" or slit along the middle between the bōng,i,tōz.

Bōn·g,i,tōz are then the lateral ridges along the edges of the primitive trace (bōngito).

Bōmn,io is the blastoderm or blastodermic membrane, *out-in*-plates.

Bōm,io; out-plate is the "ektoderm."

Bōn,io; in-plate is the "endoderm."

Bōng,ōn is the furrow between the bōn·g,i,tōz.

Bōng,ōm is the closed and combined bōng,i,tōz; the incipient vertebral column, apart from its contents; the closed cavity to contain the brain and the spinal cord.

NOTE.—(1) When the sound NG, for which we have no single letter in the English alphabet, occurs before the hard G-sound (as in give) or before K, it is represented by N· instead of NG, to avoid the awkward combinations NGG and NGK. The difference between NG and N·G is that between the NG in *singer* and in *finger* (=*fingger*).

Bōngrōng is the vertebral column, and its cavity and *its* contents confusedly or indiscriminately regarded.

Bōng,ōn,in is the spinal cord (what is *in* the bōng,ōn).

Bōng,ōn,in,do; the fetal brain (-DO=head of).

Bōng,ōn,in,go; the spinal-cord proper, *minus* the brain.

Bōng,ōn,in,go,do is the *medulla oblongata* (the head of the spinal cord proper).

Bōmn,i,ōmz are the dorsal plates of the blastodermic membrane.

Bōmn,i,ōnz are the abdominal plates of the blastodermic membrane.

Bōn,io,sta is the endodermic system, the development of the internal layer of the blastodermic membrane known as hypoblast, from the upper side of which a proliferation of indifferent corpuscles gives rise to the mesoblast of the books; but this origin of the mesoblast is not constant, for it sometimes arises from a like proliferation of indifferent corpuscles from the under side of the epiblast, thus presenting us with a double origin of this source of specialized metabolism. In one and the same embryo it is often produced by a conjoint proliferation from the two layers, epi- and hypo-blast. To come, here, within appropriate limits, the specific namings in this degree of detail are omitted:

Bōn,iōn is the abdominal or hæmal cavity.

The preceding exhibit is embryonal and special. To render it more thoroughly intelligible on both the phonetic and the physiological sides of it, the following additional elaborations will be of essential service:

I.

CONSONANTS AND THEIR MEANINGS.

D; head, knob.
G(hard); trunk, shaft, process. } B; body; *deadness*-build.

Z; group, mulberry-form (herd, flock).
Zh; embranchment, tree-form, arboraceousness. } V; organ; *liveness*-build.

T; unition, rivet.
K; division, divarication. } P; joint, hinge.

S; constellate form.
Sh; radiate form. } F; fan-shape, plexus.

M, out; N, in; Ng, neutral, between; L, whole; R, part; (W, wavy, doubtful; Y, assertory, positive; H, attenuated, breathy, hæsitive, hesitating; see below.)

II.

Stated in a somewhat different order, mixed in with a few combinations, and with approximations of their meanings on the one hand towards their lingual, and on the other hand towards their physiological meanings, the list may be re-presented after this manner:

W; question, hemispherism, bilateral symmetry.

Y; answer, *septum lucidum*, septum of the bilaterism.

H; hush, breath-holding, silence; breath, *halitus* (spirit-like).

L; wholeness, whole-ism, unbrokenness, continuousness, string-likeness, permanency.

R; partness, brokenness, discontinuousness; lax, fluxy, periodicity-like, temporary.

M; affirmation, YES, outness, exteriority, bigness.

N; negation, NO, inness, interiority, littleness.

Ng; neutrism, indifference, neitherness, passing over into obstinate or persistent, *successfully affirmed-and-negated* assertion, unstable and indeterminate but each way assertory equilibrium; elasticity, *cartilagism.*

N·g(=ng+g); out-along-ism, persistent or determinate affirmation or negation; hardness, bone-ism or bone property.

G; produced shaftism; bone form.

Nd; in-head-ism, single contractile lumpism; *muscle-ism.*

D; head, bulb, or knob-like object or form.

Mb; affirmative or external mass-presentment.

B; bludgeon or mace-shaped object, shaft with bulbous end, *deadness*-like presentment.

V; *liveness*-like presentment, complex mass-presentment (cysts and tubes), *glandism* (epithelial, secretory, etc.)

Z; congeries of cysts; animaloid (flock, herd-like).

Zh; congeries of tubes; vegetaloid (tree, plant-like).

P, Nt, N·k, Mp; hingings, joints (syndesmological).

F; complex and multiplex minutiæ, confluent and dispartive.

Fl; fluidity, water-like presentment; blood, etc.

Fr; fractility, reflective, refractive, radiative, light-like presentment; *nerve* (intelligence, inter-ligence, *tie-together* of the entire system).

III.

Still again re-arranged with more immediate and special reference to physiology (and running mostly in connection with the vowel o), the consonant distribution reappears as follows:

Bōl,io; the androideum (a new coinage to denote trunk, head, and neck).

Bōr,io; the *limbi* (or limbs as detached or considered apart from the trunk).

Bōlr,io; the appendieulæ—the limbs or appendicular portions of the body, considered as attached to the androideum, and hence as implying it, and so, by inference, meaning *the whole body*, with this particular composition (androideum and limbs).

Bōm,io; the body walls (literally outness-dom or walls-dom), the ektodermic system, the development of the outer layer of the blastodermic membrane.

Bōn,io; contents of the body walls, the endodermic system, the development of the internal layer of the blastodermic membrane=bo,hwau,io.

Bōng,io; neutral mass, CARTILAGE, gristle, chondroid mass.

1. Bōng,l,io; permanent cartilage.
2. Sc,bōng,l,io; non-articular permanent cartilage.
3. Bōng,r,io; temporary (*i. e.* inter-rupt-ory) cartilage.
4. Bōng,lr,io; articular permanent cartilage.

Bōn·g,io (=bōng,ghi,o); BONE (bōn·g,io,sta; bony system, skeleton).

1. Bōn·g,l,io; ossein or bone cartilage (in close relation with bōng,l,io).
2. Bōn·g,r,io; bone-ash when separated.

3. Bōn·g,lr,io; the bone-ash substance in its normal connection with the ossein.
4. Bōg,io; shaft-like structure, bone-shape (closely allied with bōn·g,io).

Bōnd,io; MUSCLE (in-heading, bunchy, contractile).
1. Bōnd,l,io; smooth or non-striated muscle.
2. Bōnd,r,io; striped or striated muscle.

Bōnd,lr,io; SINEW, fibrous tissue.
1. E,sa·s,bōnd,lr,io (*ay-sas*, etc.); yellow or elastic fibrous tissue.
2. O,sa·s,bōnd,lr,io; white or non-elastic fibrous tissue.
3. U,sa·s,bōnd,lr,io (*oo-sas*, etc.); fibro-cartilage.
4. Bōd,io; head-like, bunch-like, contracted muscle-shaped structure (closely allied with bōnd,io).

Bōmb,io; mass-presentments, external embodiments of bone and muscle (butchers' meat type, etc.)
1. Bōmb,li,o; integral mass-presentments.
2. Bōmb,r,io; fractional mass-presentments.
3. Bōb,io; inert, *deadness*-like, cadaver-like sustentory mass, bone, muscle, etc., as contrasted with bōv,io (see below), the liveness-mass. Bōb,io is closely allied with bōmb,io.

Bōv,io; GLANDS, glandular and special organic mass, *liveness*-mass (as contrasted with bōb,io above); glandular, secretory, epithelial; special-sense organs, etc. (The major physicoid, or life-bearing system, tissues, and organs.) Cystoid-and-tubuloid.
1. Bōzh,io; the vegetaloid or predominantly tubuloid, glandoid-mass.
2. Bōz,io; the animaloid or predominantly cystoid, glandoid-mass.
3. Bōv,l,ia; secretion.
4. Bōv,r,ia; excretion.

Bo,vau,i,hwau,io; glandoid and *liveness* organ(ism)s.
I. Bō,v,au,io; systemic and special organs (extra-visceral).
Vīts (*veets*); cells (zhītsvegetaloid) and corpuscles (zhītsanimaloid).
Vēts (*vayts*); fibers, living strings, and other thread-like organs.
Va·ts (*vats*); membranes and membranoid expansions; the skin, in pre-eminence, the seat of palpation or the sense of touch.
Vat (*vaht*); thick-th or brawn-like; seat of the muscular sense.
V·u,bo (*vuhbo*); the nose, organ of the sense of smell.
V·o,bo (*vaw-bo*); the ear, organ of the sense of hearing.
Vo,bo; the eye, organ of the sense of sight.
Vu,bo (*voo-bo*); the tongue, organ of the sense of taste.
II. Hwau,io; the viscerismus, the total aggregate of the visceral organs. (Will be distributed in a subsequent report.)

Bōn·k,io; joints(bon·k,io,ski; syndesmology).
1. Bōn·k,l,io; ligaments.
2. Bōn·k,r,io; synovial membranes.
3. Bōn·k,r,ia; synovia.
4. Bōn·ks; the sundering fissures or clefts of the joints.
5. Bōnts; the unitions or *joinings* of the *joints*.
6. Bōps; hingings, the meeting-and-divisional aspects of joints.

7. Bōmps; joints (bōps) especially as seen from outside, as swellings or protuberances; whence also bōmps (bumps) for any similar protuberances, phrenological, etc.

Bōf,io; *glanduloidity* (the minor counterpart of bōv,io). For this, as embracing the circulations in a very general sense, the new technicality *glanduloidity*, as if imitating the glands (compare the heart and the brain with the liver), has been adopted.

I. Bō,fl,io; fluidity (gland juices, etc.)

1. Bōsh,l,io; slushy or crude fluids or liquids, plasmas, peptones, emulsions, leakages, lymphatic, lacteal, etc. Minor physicoid or life-bearing system. PROTOPLASM.
2. Bōs,l,io; *developed* fluids, blood, serum, mucus, oil, tears, etc. (Bōs,l,l,io; venous blood. Bōs,l,r,io; arterial. Bōs,l,lr,io; capillary.

II. Bō,fr,io; NERVE, stella-solar-and-radiant-mass; the physicoid life-bearing (or mentoid) system, tissues, etc.

1. Bōsh,r,io; the sympathetic nerve system, tissue, etc.
2. Bōs,r,io; the cerebro-spinal nerve system, tissue, etc.
3. Bō,fr,r,io; the gray matter.
4. Bō,fr,l,io; the white matter.

In addition to the preceding technicalities, Mr. Andrews has furnished your committee with the following diagrams with their accompanying explanations from unpublished manuscript works.

DIAGRAM I.

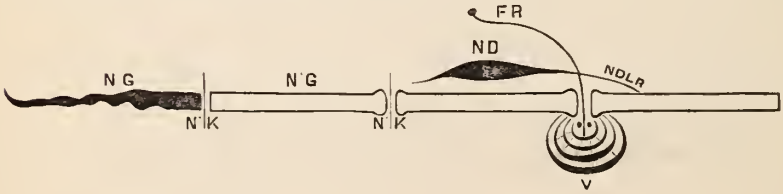
Illustrating the ideal or typical origin of bone and joint from the prior chondroid mass.

EXPLANATION.

ng; chondroid, cartilage, or gristle.
n·k; crack, crevice, or cleft; incipient joint.
n·g; bone, hardened cartilage; articulated mass.

DIAGRAM II.

The same with increased elaboration.



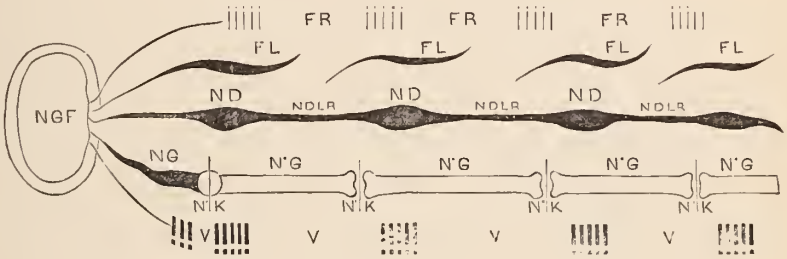
EXPLANATION.

ng; cartilage.
n·k; joint cleft.
nd; muscle, contractile mass.
fr; incipient nerve, simulating the ray of light through the cleft.
ndlr; the sinew (tendon); breaking joints and connecting.
n·g; bone; the hardened shaft with headings or bulbous-ends of its own; bludgeon-shaped.
v; gland, synovial exudent, bursal, secretory, epithelial, *bud-like* or *liveness*-like; organicoid, splanchnoid, and limitary; the specially vitalic domain; the exact analogue of the *bud* (seated at the joint) in vegetal anatomy; whence the French *bourgeon*-(*i.e.* bud-)shaped.

DIAGRAM III.

Larger view of the primitive type forms of the tissues and joints, developing from the still prior myxomatous mass.

The *ngf*, *ng*, *n·g*, and *ndlr* are collectively called connective tissue by Carl Heitzmann and perhaps by some other German histologists. The term is vague and undefined with other authors.

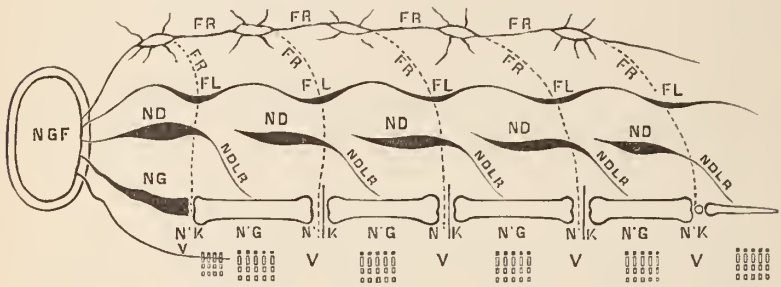


EXPLANATION.

ngf; myxomatous or embryonal tissue, undifferentiated blood, nerve, connective tissue, etc., out of which the specialized tissues arise. A sample of this primitive tissue remains in the gums, even of the adult, of which they are mainly composed.
ng; cartilage.
n·k; joint.
n·g; bone.
nd; muscle.
ndlr; sinew.
fl; fluid.
fr; nerve.
v; gland.

DIAGRAM IV.

Primitive type-forms of tissue, etc., modified by nature's ARTISTIC MODIFICATION, towards their actual condition *in situ*.



EXPLANATION.

With allusion to the corresponding telluric or cosmic structure.

ngf; myxomatous tissue—primitive earthy chaos.
ng; chondroid mass—petroids, clays, etc.
n·k; joints—clefts, seams, "veins."
n·kr; synovia—metallic ores in rock-veins.
n·g; bone—rock.
nd; muscles—soils, loams, etc.
ndlr; sinew—asbestos, rock-fibers.
fl; fluid, blood, etc.—water, streams, etc.
fr; nerve—solar and stellar light.
v; glands, organs, etc., vitalic—vegetal and animal kingdoms.

Of the preceding discriminations the following six are usually assumed as the most governing under the double name of tissues and systems:

1. Bōng,io; cartilage.
2. Bōn·g,io; bone.
3. Bōnd,io; muscle.
4. Bōnd,lr,io; sinew (tendon, etc.)
5. Bōv,io; gland (secretory, epithelial, etc.)
6. Bō,fr,io; nerve.

To these if we add the syllable, *-web*, we name them as TISSUES, or according to their fine internal structure; and if we add to them the suffix, *-sta*, signifying system, we name them as systems; thus, bōnd,io,web, the muscular tissue; bōnd,io,sta, the muscular system, etc.

In conclusion, the following are the Alwato namings for the principal divisions of biological and medical science:

Bodo,b(io),ski; anatomy.
Bodo,v(io),ski; physiology.
Bodo,hal,ski; hygiene.
  Bodōr,ski; surgical pathology.
  Bodōlr,ski; medical pathology.
  Bodōl,ski; surgical therapeutics.
  Bodōrl,ski; medical therapeutics.
Bodo,bau,ski; direct anatomical, ingrediential departmentology.
Bodo,bo,ski; anatomy proper, anatomical promorphology.
Bodo,bu,ski; anatomical mechanics.
Bodo,biu,ski; anatomical sexology.

DISCUSSION.

Dr. Atkinson: I am in no proper condition to speak upon this subject, but sometimes the lack of preparation is the opportunity to say the best things. I am fully aware of the depth of the subject of terminology that was presented last night, and read so clearly and so patiently by my friend and co-laborer in that field, Stephen Pearl Andrews. I noticed a disposition of restlessness that I was sorry to see at this time in this body. This has occurred before when papers were being read in this Section; but we enjoy the satisfaction of each year having a few come up to better appreciation of this abstruse subject. The paper read last night is but a continuation of the three reports previously made before this body on terminology; and I was convinced from intimate association with Stephen Pearl Andrews that he had the key to this whole question of properly expressing the various degrees of mental activities, so as to exactly represent in sounds the affections of the mind.

The proposed lay-out is not yet complete, but those who have studied the former reports should have been able to follow last night; but each report is a little in advance, and is not quite comprehended. The disposition has been to resist it, and not candidly entertain it; when anything was said that they could not quite comprehend, it was scouted as if personal insult was offered, and that too when proffering them the rich treasures of intuition, attended by close study of an earnest mind. That is the way that it seemed to me. We saw last night how, for the lack of just such a means of pronunciation, brilliant men made dreadful blunders. What shall

we do? I beg patience and attention for one or two years more until this issue has been pronounced, until the case is fully before the court; and then when it comes up we will be able to demonstrate to you the reliability of what has been said. We will not be shoulder-strapped with mere memory of the dogmas that have stood in the way and made us differ. If we would inquire *how* we differ, and try to learn where each individual stands more than to ask *why* we differ, we would be better peacemakers, and we would be better fitted for the instruction of this body. I have not the time nor the disposition, nor you the preparation or patience to follow the depths of the paper that was presented to us, and I ask you one and all as you know me to be in earnest, not for myself, but for you and for all,—I ask you to patiently study this with former reports so that you may not come, as many of the lights in dentistry have come to my office after the Transactions had been out over a year, and given no evidence of their having even glanced over my former reports on this subject.

Dr. Waters: I have heard these papers heretofore with a great deal of pleasure. It is a matter I have had some previous thought of. I started in an examination and investigation of that subject many years ago. I suppose Benn Pitman must have to some extent given me the first idea on that subject. S. P. Andrews, of this city, may, I suppose, be the father of it in its present form. At any rate I consider that man an inventor, a discoverer of that idea. He is just as much a discoverer and inventor as anyone, as the discoverer of a new machine, or a new instrument, or a new use for a new article. The thought that came to me as I listened to Dr. Atkinson, and as I looked around and saw how little interest was taken in what he was saying, was that he was not understood. There came to me the story of the boy who had been to Europe with his mother; she sent him to a German school; he was a little fellow, and when he came home, she says, "What did you learn?" He says, "Nothing." "What did the children say?" "They said, 'goloshes.'" "Nothing but that?" "Nothing; nothing but 'goloshes,' 'goloshes,' all the time." What were goloshes? Their rubber shoes; when they went in the shoes were taken off, and they put them in their places, and when they went out it was calling for goloshes, and when they came in it was take off goloshes, and he had that one word, and everything else was in a jumble of sound and seemed like goloshes. He was confused, and so it is with other people. When a new idea comes before them for the first time, unless that idea is repeated over and

over again (men are like children; they are children of a larger growth), the idea is not accepted because not understood. So it was with Dr. Atkinson's first paper, and so it was with his second paper. If I were going to start on that ground I should begin with the first breath, and I would say, what does it mean? It means the giving birth to a soul; a starting in life; the first breath. And so from the breath I would build up the human voice or speech, with the glorious ideas that come with it. Here is a man who has commenced the work and carried it up. If not all, some of that will be accepted by us if we live long enough. But there is a great deal of old fogyism in the land, and it takes a life-time to get a new idea in; and it takes a life-time to drive the old fogyism out, and the old fogyism must be started out first. Here you are all spelling from infancy, and spelling "though" which might be written t-h-o, or, if you knew how to write phonography, with two signs, th (giving the sound of th in thee) and o. We ought to have another letter that should be instead of t-h. You ought to have a sign for that sound, and the meaning of Dr. Atkinson's paper is just as great and just as clear to my mind as that t-h-o-u-g-h never should be taught in our schools as spelling "though." I cannot discuss his last paper because I did not hear half of it, but I can say this much, I hope the next time he gives a paper on this subject, he will give us a résumé of the points previously made in the first place—go over the whole ground—and that you will then be able to see there is something in it.

SECTION IV.

Operative Dentistry.

Cylinder Filling.

Paper by GEORGE J. FRIEDRICHS, of the Section.

IN these days of cheap dentistry and in the face of the "New Departure (which is synonymous with cheap dentistry and want of operative skill), I desire to call your attention to the method of cylinder filling with non-cohesive foil, brought before the profession by the late Dr. J. S. Clark, the author and inventor, at the first session of the American Dental Convention, held in Philadelphia in 1855.

In giving his invention to benefit mankind and his co-laborers in the field of dentistry, how was it received? I am sorry to say with indifference. In fact, if I have read the transactions correctly, it was "Nothing new under the sun," and so stated by some present at that convention, who stultified themselves by trying to describe their method of manipulating gold foil in the form of cylinders.

I am well aware that this is not the time nor place to teach dentistry; nevertheless, in bringing this subject before you, I am in a measure compelled to demonstrate—

1. The manner of preparing the cylinders (as those prepared by the manufacturers of foil are only in part practical.)

2. The instruments necessary with which to pack them.

3. The manner of introducing them in order to make an impervious and solid filling.

It stands to reason, if we fold a sheet of No. 4 foil upon itself we shall have the sheet one-half its original size and in the shape of a parallelogram. If this process is repeated five times we shall have a strip of foil thirty-two times the thickness of the original sheet, and so on; but as the number of layers increases, the flexibility of the mass decreases and it becomes less pliable. Therefore, in order to make small cylinders and yet leave them soft and pliant the sheet

must be cut into halves, thirds, and fourths. The smaller sizes of cylinders are not yet in the market, and those who use cylinders entirely in filling are compelled to prepare them themselves. Besides, applicable cylinders are yet to be prepared by the manufacturer of dental materials, for should I be compelled to rely upon those they now furnish I doubt very much (though I have practiced cylinder filling for the past thirty years) whether I could make a compact filling with them, and I have no doubt that this in a great measure is the reason why this method has not been more generally adopted by the profession.

The instruments necessary, and without which no cylinder filling can be made as taught by the inventor, are similar in shape to Nos. 19 and 20, designed by Dr. W. G. Redman, exhibited in Dr. Garretson's *System of Oral Surgery*, Fig. 102, page 324. To form a set of these, a dozen sizes at least are requisite—round-pointed, turned at an angle of about thirty-five degrees, slightly tapering from shank to point, and spring-tempered; the smallest in diameter to be about the thickness of a cambric needle, the next one a third larger, length from shank to point to increase with size, and so on.

The method of manipulating the cylinders is as follows: Choose the first one of as large a size as can be conveniently introduced into the cavity to be filled, the cylinder being of sufficient length to protrude somewhat above the orifice of the cavity, in order to have material for condensing when no more gold can be introduced. This first cylinder is then forced against the parietes of the cavity by introducing the largest size of the above-mentioned instrument that the cavity and cylinder will admit of, when space will be found made for the introduction of the second cylinder. When the cavity is full, although not densely packed, one of the small-sized instruments aforesaid is then forced in between the cylinders; this opening is then enlarged by the next one in size, repeating this process—being governed in this procedure by your judgment as to how much lateral pressure the tooth you are filling will stand, as if this pressure is carried too far there is danger of splitting the tooth. Filling this space with an appropriate cylinder the process is to be repeated, care being taken that none of the cylinders choke, but go clear to the bottom, until the filling is completed and packed as solidly by lateral pressure as the strength of the tooth will admit of. After which the surface should be condensed, dressed down, and polished.

With an ideal filling are associated certain requisite conditions:

Firstly—The material employed must be, to all intents and purposes, indestructible in the oral cavity. Secondly—It must be packed sufficiently solid, so as to render it impermeable to the fluids and other substances with which it may be brought in contact. Thirdly—It must be flush with the orifice of the cavity and finished in such a manner that it can be kept clean.

Now, by this method of using cylinders, can we arrive at or approximate making an ideal filling?

I will give you the points of excellence and leave you to draw your own conclusions:

1. A sheet of foil is still a plate of metal retaining its due share of tenacity. When the sheet is folded the tenacity increases; therefore, when a cylinder of gold foil is placed in a cavity in a tooth, you have a laminated mass of gold that reaches from the bottom to the surface. Consequently a cylinder filling never comes out by piece-meal; it either comes out *en masse* or else it stays where it has been put.

2. Lateral pressure being brought to bear on the gold while still soft from the commencement and continued to the end of the operation, a perfect adaptation to the parietes of the cavity must ensue.

3. When a tooth is strong enough to bear the pressure, a solid and impermeable filling can be put in by lateral pressure alone, which is a desirable item in difficultly located cavities—such, for instance, as proximal cavities between the bicuspids and the molars.

4. No retaining-points are requisite to keep the gold *in situ*.

5. Rubber dam may be entirely dispensed with, and no matrices are required in filling proximal cavities; for, if you let your cylinders protrude sufficiently beyond the orifice of the cavity, they can be finished up to give the desired fullness.

6. Submarine fillings can be made with them.

7. By this method an impervious filling can be made with more certainty in less time and with less labor than by any other mode practiced up to the present time. For, after a cavity is prepared and ready for the gold, it can be filled by this method, provided the cylinders are ready-made, in ten minutes,* whether the cavity is large

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* Dr. Bogue brought this subject up before the New York Odontological Society (*vide Dental Cosmos*, Vol. xxiii., No. 2, page 87.) In the discussion he relates: "When Dr. Atkinson introduced heavy gold for our use, like all the rest of us, I experimented some. I took a steel plate one day, making up my mind to put

or small, whether it is situated on the grinding surface or in a posterior proximal cavity of a molar; that is, your gold is packed ready for surface-condensing and finishing in the time above specified.

I read or heard the remark made that cylinder fillings are excellent in simple plain cavities. Well, I am willing to forgive that man, for he evidently did not know what he was talking about. But in one sense he was right, for what are truly difficult cavities to fill by other methods, really become, when cylinders are employed, simple ones. There is only one thing that cannot be accomplished with cylinders, and that is, an artificial crown cannot be built up with them; but aside from this, whatever can be done with gold in the mouth for the preservation of the teeth, can be effected with cylinders.

Crystal gold and cohesive foil were a god-send to thousands in our profession, for they enabled many—and do yet—to put some kind of a gold filling in that will stick for awhile. When failures followed, it was then found out that only those met with success who took sufficient time, and packed their gold in small quantities against the parietes of the cavity as they progressed; for they well knew, if a perfect adaptation was not attained at this point of the operation, no amount of pressure or malleting would adapt the gold to the walls of the cavity ever afterwards; for when the packing was once completed, they had a coherent mass of gold which had more of a tendency under pressure or malleting to contract upon itself than to spread.

in as good a plug as I knew how. I put that filling in in one hour and ten minutes. A few weeks later, while talking with Dr. Moffatt, I asked if he ever used cylinders. He said 'No.' I then showed him this experimental filling that took me an hour and ten minutes to insert with cohesive gold, and said: 'The same steel plate lies here. I will see what I can do with cylinders.' The cylinders were ready-made. Just as I made that statement, the church bell rang. I filled that cavity in twelve minutes, filed it off and burnished it—the same identical hole in the steel plate that it took me an hour and ten minutes to fill with heavy gold. The plug was driven out afterwards. I think I have it yet. It is coherent, and the gold was supposed to be non-cohesive gold."

Dr. Brockway: "How did it compare with the other filling?"

Dr. Bogue: "It was far more perfect and better adapted to the walls than the first was, but it was soft. Our friend, Dr. Latimer, poked it with a lead-pencil and made a dent, and I suggested that if it was in a tooth it would not be poked with a lead-pencil, and would not be liable to be destroyed in that way. Every little imperfection—marks of the instrument with which the hole was bored—was seen in the softer filling."

Therefore, my conclusion is that a filling made of cohesive gold is either a good or a very poor one. The difference between it and a cylinder filling is, the former remains in contact with the parietes of the cavity from mere adaptation, while the lattter not only remains in contact from adaptation but, from the mode of introduction, is held there by the tension of lateral pressure also.

The only true method by which a root-filling can be made with any certainty, is on the principle of cylinder filling; for, the gold rolled in a cone—the shape of the pulp-canal—becomes, in part, the instrument by which the object is accomplished. In looking over the methods given by different authors for root-filling, I could not help smiling to see the array of nerve-canal pluggers, represented as necessary to perform this operation; when the very object can be accomplished with a foil-carrier, a piece of untempered steel the thickness of a darning-needle, about an inch and a half long, tapering down to a point, the shape and size of the pulp-canal, and a pair of flat-nosed pliers.

The modus operandi is: With the foil-carriers, introduce the first cone into the canal, care being taken not to force it through the foramen at the apex of the root; then take up the above-mentioned steel instrument and push it up beside the gold cone. When forced as far as you can with your fingers, grasp it with the pliers, forcing it into the canal as far as it can be made to penetrate. Withdrawing the instrument gives room for the introduction of the second cone. Repeating this until no more can be packed into the root-canal completes the operation. The cones are prepared by taking a strip of foil and rolling them on a common watchmaker's broach.

In conclusion, let us look at this question from another standpoint. The value of gold as a material is, comparatively speaking, of no consequence in the filling of the teeth. It is the skilled labor and the time required that are the valuable factors in the case. Therefore, if a sufficient number of fillings can be put in by whatsoever method, even at moderate charges, a fair remuneration for the skilled labor employed is obtained; while if it takes three hours to insert one filling, the fee exacted must be in proportion to the time and labor expended. Hence the cry by a certain class of the profession for a cheaper material, on the plea that this style of work places the services of the dentist out of the reach of the majority of the people. Then again, how can you reconcile your consciences to the fact that in packing and malleting for hours, you are making your patient suffer the torments of the damned, while your prede-

cessors in dentistry accomplished the same results without entailing one-fourth the suffering. What are the consequences that follow? Gutta-percha, oxychlorides, and amalgam are invoked, and these are placed on a par with a material that has stood the test of time. Now, Gentlemen, is not this a picture of the true inwardness of where the profession stands at the present day?

SECTION IV.—Discussions.

Root-Filling.

Dr. Atkinson: Whenever a tooth is removed from the human body, and is in connection with any portion of living tissue through which protoplasm circulates (wherever the containing chamber is), it will be filled with protoplasm. And if it meets with a ferment, it will go into decomposition or be encysted. If the poison or ferment be weak, it will be limited, and the root will be encysted and be useful. If the infection be virulent in quality or considerable in quantity, retrograde metamorphosis will ensue, limited by treatment or constitutional vigor. That is the great point in the case. I studied this closely, and became convinced that it made no difference what you filled the root with if you only hermetically sealed it. It made little difference whether it was full from the point of the root to the pulp-chamber if it had been disinfected. My present idea is this: that the best filling for the root of the tooth is oxyphosphate of zinc. Any substance that is plastic enough to entirely exclude all the protoplasm is sufficient. Should abscess be threatened, all you have to do is to make a very simple operation. Take a bit of cotton wet in chloroform to obtund the sensibility, and with a sharp lancet go through the gums and the alveolar process to the end of the root, and down to the cement. You need not even dress it. Just let it alone quietly. In ninety-nine cases out of a hundred you will succeed. The point is this, that through ignorance dentists over-treat nine-tenths of the cases they have in their hands.

Dr. Wetherbee: There is a great diversity of opinion with reference to the best method of filling pulp-cavities. There are those

who believe that gold is a most excellent material, and that in a majority of cases it may be carried to the foramen, preventing the possibility of the formation of gases in the pulp-cavity. Others believe in the use of gutta-percha dissolved in chloroform, claiming that it can be forced to the foramen without difficulty. Again, some practitioners believe in filling pulp-canals with oxychloride or oxyphosphate of zinc, as these can be more easily and surely forced to the end of the canal, claiming advantage over other materials in their antiseptic character.

Of the latter class is my highly-esteemed and eloquent friend who has just taken his seat. I take issue with him with reference to filling pulp-canals with oxychloride or materials of like character. In the first place you cannot be certain that you have carried the oxychloride or oxyphosphate to the foramen. In the second place, if you shall have done so, and the cavity is absolutely filled, and it shall have hardened, how long will it remain in that condition?

I have had occasion to treat very many teeth whose pulp-canals had been filled supposedly well or perfectly with oxychloride (not by myself, as I never use it). In those cases without an exception I found disintegration of the material to a greater or less extent to have supervened. It may be suggested that these failures were due to imperfect manipulation, or to the poor quality of the material used. But the fact is, oxychloride, as also the oxyphosphate, of zinc is an absorbent. They take up the moisture from the dentine, and become disintegrated in the course of time; when thus disintegrated the generation of mephitic gas may follow, and pericementitis will usually supervene.

I had a case in point to treat one year ago last winter. It was the right superior central incisor, filled by a gentleman who is a positive friend to oxychloride. Three years previous to this time, he had supposedly well filled the pulp-canal with oxychloride. After the lapse of three years, an opening was made through the palatal surface to the pulp-canal; through the oxychloride I carried a broach to the end of the root. This operator considers himself an expert in this line of practice. So much for oxychloride, whose integrity is of such doubtful character.

The above results may not obtain in the use of gutta-percha; but where there is room to use this material, there is generally room for the skillful hand to use gold, and the latter is always to be preferred. But I am met at once with the declaration that gold is more expensive, as it requires more time. Alas! who of us are to

count time when the best interests of our patients are involved? I have very little difficulty in filling pulp-canals in incisors, cuspids, and bicuspids. I believe that where you may carry oxychloride, or gutta-percha dissolved in chloroform, you may also with labor and care carry gold. It is claimed that oxychloride and gutta-percha are therapeutically better for the root than gold. I deny it, and demand the proof.

Dr. Atkinson: I appeal to the house if in my remarks I said "oxychloride" at all. I said "oxyphosphate." The idea of jumping at the conclusion is preposterous and unsafe. All of you who know anything about it know that oxyphosphate will set, if mixed intelligently, under saliva or water, and will *harden* so as to fill the chamber perfectly. The statement as to no oxychloride of zinc being impervious to the fluids of the mouth, does not amount to anything. We all knew that long ago. I am talking about oxyphosphate. If they know anything they know enough to go beyond the end of the root without incurring danger, if they do not carry a ferment from a dirty instrument—look out if you do that! Do it with your whole soul, and you will succeed in every instance. No use of talking "nine times out of ten;" you will have success in every case. Nature never lies. When you are certain it is nice and tight, fill the whole chamber up, and build on the crown of the tooth at the same time, and I think that is enough on this point. The great difficulty is that they were positively afraid to go through to the end of the root of the tooth. By the use of the oxyphosphate for filling pulp-canals, you can save all the labor necessary when gold is used, and secure a filling that is more complete than any man can make with gold in the canals. It is worth your attention to follow what I have said in filling with oxyphosphate, which is better than any oxychloride that I have ever seen, except the old make. I have seen that in the teeth without wasting for fifteen years and just as flush as I could wish it to be. When we fill with oxychloride or oxyphosphate we should leave shell enough to put a gold cap over and make that impervious. You get this advantage: That the conduction or conductivity of either oxychloride or oxyphosphate is so nearly allied to the tooth-substance, that the patient receives no shock, the thermal current being cut off by the depth of this non-conductor.

Dr. McKellops: For the last seven or eight years I have been giving special attention to the subject of the best material for filling root-canals; and I have tried our distinguished friend's method of

introducing oxychloride or oxyphosphate of zinc with cotton, but with my best endeavors have found it impossible to perfectly fill such canals. But wherever I can get the point of a broach, say the finest Stubs's steel broach made, I can, by the use of gutta-percha dissolved in chloroform, fill such canals perfectly. The operation in case of the anterior roots of the lower molars, or the buccal roots of the upper molars, requires a great deal of work and a great deal of care and patience. But if a man only has patience and perseverance, and loves his profession, he can accomplish every time the best results, even in the smallest and most crooked canals. A gentleman says it takes a long time to fill such canals with gold. It does not take one-tenth part of the time to fill them with dissolved gutta-percha because gold cannot be got into these canals to fill them perfectly. There never was a man that did it. In the use of gutta-percha there need be no fear of its setting, because if it becomes too hard by the too rapid evaporation of the chloroform you have only to use a little more chloroform and it will immediately soften again; and after the root is partly filled with the dissolved gutta-percha, and the latter is still soft, take a piece of gutta-percha that has not been dissolved, cutting it so as to approximately fit the canal, and after warming it, by pressing it up into the canal, you can force the soft material quite to the apex of the root, and even beyond it. The patient will give you an indication of its reaching that point, as it will frequently cause a slight pain. If you will remember, I brought this matter up two years or more ago at Niagara Falls, and I have been steadily using this method ever since, and have yet to see the first case that I have lost. I have had periostitis occur and last for a week, but with a little treatment and a little encouragement to the patient, that has gradually passed off. There are other gentlemen present who have tried this method, but I wish to say to the profession generally, all I ask is for them to give this method a fair and square trial, and if they will do so, I will guarantee that there is not a man who will afterwards try to use gold unless in a perfectly straight canal.

Dr. Barrett: With gold it is utterly impossible to fill very small or tortuous canals; with oxychloride and oxyphosphate of zinc it is more feasible, but by no means easy. They stick and clog and so soon as crystallization commences that is the end of the operation. To properly fill a nerve-canal sometimes requires considerable time, and this neither of the two fillings mentioned will afford. It frequently requires half an hour, and you know that for such operations

they are utterly unsuited. When they have once commenced granulating there is no method by which they may be again rendered fluid. To my apprehension there is but one thing that fully fills the bill and that is gutta-percha dissolved in chloroform as recommended by Dr. McKellops. I have now used it for a number of years with constantly increasing satisfaction. With a Donaldson nerve bristle dipped in the solution I work and work the gutta-percha up to the very apex of the tooth. If the course of the canal be crooked or tortuous I wind a few hairs of cotton about my broach and using this as a piston I carefully force the gutta-percha onward—carefully, because if the foramen be open it is easy to force it through. Watch your patient and he will very quickly let you know when the canal is full. If the gutta-percha becomes too thick its consistence is easily changed by dipping the broach in chloroform or by simply warming it. The gutta-percha not only fills all the minute channels of the canal but in cases of loose histological structure it will penetrate to and fill all those little communicating chambers sometimes found in teeth of that character. I remember experimenting with one such recently removed tooth and after closing the apical foramen and then forcing the gutta-percha into the roots I found it exuding in exceedingly minute threads from a number of places upon the surface of the root. Upon subsequently cutting the tooth up I found numbers of these communicating chambers in the dentine and each completely filled with gutta-percha. With what other material could this result have been obtained? I believe, too, that it is more compatible with the tissues than is any metallic or irritant root-filling. Even when I have had good reason to suspect that some of the material had found its way through the foramen of the tooth I never knew it to cause any more than temporary mild disturbance. It is very soon absorbed or encysted and ceases to be a source of disturbance. But its successful use requires patience and experience. These having their perfect work I know of nothing that can take its place as a root-filling.

Dr. Brophy: At the last meeting of this Association Dr. Talbot called the attention of the members to a set of instruments he had invented for the purpose of straightening root-canals, and by the use of which the filling of roots is made extremely easy. If, however, the root be very tortuous, it is of course more difficult, and in some instances impossible to ream it out to the apex; but even if this cannot be done it is an advantage to enlarge the portion nearest the pulp-chamber, so as to make the introduction of the filling more

easy. The point of the instrument will not cut; it however follows the canal, and the sharp edges cut or chip off the walls of the canal, enlarging and straightening it. The root may be filled with gold, but I prefer and consequently use oxychloride of zinc, which I believe to be the best material in use for this purpose. Oxychloride of zinc adheres to the walls of the canal, hence it effectually excludes moisture. It is both antiseptic and disinfectant in its action, therefore any remaining mephitic gases in the canal are neutralized and rendered harmless. Oxychloride of zinc is easily manipulated when properly mixed, and a tooth whose roots and pulp-chamber are filled with it cannot become dissolved.

It has been said that oxychloride of zinc sets or hardens too quickly to enable the operator to manipulate it satisfactorily. If water, one part, be added to chloride of zinc, two parts (I speak of the liquid zinc chloride which accompanies the zinc oxide prepared and sold for dentists' use), no difficulties can be experienced in using it, as the hardening of the cement is retarded sufficiently long to permit the operator to thoroughly finish any root-filling.

Dr. McKellops: What is the use of using this Talbot instrument, incurring the danger of breaking its fine steel point in the root, or of cutting through the sides of flat or curved roots, when by the use of gutta-percha these dangers may be avoided.

Dr. Brophy: The object in using these instruments is to enlarge the canal so that the operator can see what he is doing, enabling him to as intelligently insert a filling in the root of a tooth as in its crown. Besides, in cases where the pulps of teeth have been dead for some time the canals fill with débris, which prevents the insertion of a nerve broach or any root-filling until after this débris has been removed; and this instrument is the only one with which I am acquainted that will remove the contents of the canal *without incurring the danger of cutting through its walls.* There is an objection to the use of gutta-percha. Evaporation of the chloroform may leave a space between the filling and the wall of the canal; the space will fill with moisture, and the object of the root-filling will be defeated. I do not state this as a fact, but I believe it is quite possible.

I have used these canal reamers since the first one was constructed, and I have to say I regard them as indispensable. If the instruments are properly tempered and used they are not likely to break.

Dr. Waters: I should like to say a word or two, and I do it because I think it a good plan to talk over difficult cases. I would not get up to say how I should do an easy thing. A case occurs to

me that is very difficult. It is where the growing teeth of young boys and girls have been injured, the roots of which are not fully formed, and the opening at the apices is quite large; what are you going to do in such cases?

I had a patient only ten years of age who came with both superior central incisors injured, one broken transversely and the other diagonally across the face, exposing the pulp in both cases. In one case a horn of the pulp protruded one-eighth of an inch, bleeding freely at the surface in contact with the edge of the opening to the pulp-chamber. With much difficulty I succeeded in arresting the bleeding of the pulp, and securing it from contact with the tongue and fluids of the mouth, by building over it a covering of oxyphosphate of zinc; that remained serviceable for less than twenty-four hours, when it came off, and the pulp, bleeding less, was again covered with the same preparation; this served its purpose longer, but in four weeks I had re-covered this pulp six times. At each succeeding operation there was an improved condition, and when last operated upon there was no exposure of the pulp—nature had protected it by a covering of new dentine. The tooth broken transversely across showed along the fractured surface four minute openings into the pulp-chamber, through which there exuded a colorless fluid. I supposed that I should have no difficulty in saving this pulp. The exudations were removed with bibulous paper, but not examined microscopically, and after the application of a three per cent. solution of carbolic acid, seemed to be arrested so that I succeeded in getting a good dry surface for the phosphate of zinc, with which I covered the end of the tooth. It seemed to be doing well for a few days, and then the pericementum began to inflame; on the eleventh day from first seeing the case I removed the phosphate of zinc cap and found the pulp to be decomposing. I cut away the dentine between the openings so as to get an elongated oval entrance to the pulp-chamber through which, with a nerve or pulp-hook, I drew the pulp entire, with a small rounded sac of pus attached to its superior extremity. No bleeding followed, and after washing with tepid water and a saturated aqueous solution of carbolic acid, (six per cent.) I proceeded to put in a permanent filling by first finding the depth or length of the dental canal by a hook made on a No. 25 (wire gauge) gold wire, which I passed into the dental canal, and hooking it upon the upper edge of the root marked on the wire the point of intersection with the fractured edge of the canal. I then folded a sheet of No. 4 gold foil into a square mat, the sides

of which were equal to the longest diameter of the opening into the dental canal. Having taken the wire from the canal I passed it through a small opening made in the center of the gold-foil mat, then folded the mat down upon the wire. I then, after drying the canal, passed the mat, preceded by the hook, into it, and bending to a right angle the wire at the point of intersection which I had previously marked, allowed it to rest against the edge of the tooth; this brought the hook into the center of the dental canal and at the upper end of it. I now passed up a small root gold-packing instrument, and with care opened the mat against the hook on one side, and to nearly the same extent upon the other, taking care that the corners of the mat were not forced up and out of the canal. Having the mat thus fixed in position it was an easy matter to fill the canal below it with zinc phosphate. The gold wire was cut off at a convenient distance, and the tooth built down with the phosphate. The periosteal inflammation subsided at once, and the tooth has since been in a serviceable condition. The operation was in March, 1880.

Dr. Mills: This matter has been gone over elaborately, and it seems to be a rehash of the same thing from year to year. All who listened to Dr. Atkinson, and listened to the paper of Dr. Friedrichs describing root-filling, will have to take this fact into consideration, that there is a modicum of good in all these ways, however much men may differ. Take Dr. Wetherbee's method of filling root-canals; his is a dogmatic style of stating things. He is capable of doing things other men cannot do. Every man has not the indomitable will he has. Dr. Atkinson demonstrates what should be a *principle* of practice *as a rule*. Every man *must* admit that there are exceptions to all rules, and all of us know that in filling roots we encounter more or less difficulty in the operation. These difficulties we must devise ways and means to overcome. The man behind the instrument is the one that makes the operation, and it depends upon the power that lies in him. I can explain my methods, but the question is whether another man can carry them out. I wish to say this for the sake of men who have not had as much experience as myself. The time is coming when we will be proved men, and strong men, and let us thank God and take courage. This applies to dentists in general, so what we get here let us carry home with us, and so far as our judgment and possibilities will permit, put it into practice, and prove or disprove it.

Dr. Litch: There is good in all the views presented to us on this subject. It is as well to take it up where the discussion was left

off, and with your permission I will endeavor to replace upon the board Dr. Atkinson's diagram. I think he made a shoulder at this point, his idea being to open the pulp-canal to its fullest extent. If I understand Dr. Atkinson's practice, this must represent a tooth in which the pulp has undergone devitalization and subsequent putrefaction before coming under his care, as Dr. Atkinson does not devitalize pulps, I believe.

Dr. Atkinson: Never; not at all.

Dr. Litch: From this stand-point, regarding the tooth as in a putrescent condition, Dr. Atkinson's practice seems to me to have many points of excellence, although I cannot fully indorse the great enlargement of the apical foramen which he seems to recommend, unless it becomes necessary in the treatment of alveolar fistula. A tooth containing a putrescent pulp, or its remains, or the pulp-chamber of which has long served as a place of lodgment for oral fluids or secretions or for food-fragments, is essentially a tooth saturated with putrescent matter. It is not only present in the canal proper, but it permeates the tooth-structure, filling the tubuli with gas-generating fluids. Dr. Atkinson's free removal of tooth-substance necessary to effect the great enlargement of the pulp-canal here represented, necessarily limits the zone of putrescent tissue. I say zone, because we can hardly regard the relatively highly organized matter of the cementum as either putrescent in itself or tolerating to any extent the immediate presence of putrescent fluids. The conditions of life and death are antagonistic; they cannot coexist. Unless the tooth has undergone complete necrosis there must be a point where death ends and life begins. Dr. Atkinson's method would seem to remove by mechanical means nearly the whole mass of putrescent tissue in the tooth. It of course weakens the tooth; but it is of itself antiseptic treatment of the most radical kind. Moreover, this great enlargement of the pulp-canal renders the application of sufficient quantities of such antiseptic agents as are usually employed in dentistry much more easy, and, at the same time, as we have seen, greatly reduces the extent of putrescent tissue to be acted upon. The zinc phosphate preparations recommended by Dr. Atkinson are themselves antiseptic, a fact which certainly commends their use in this class of cases, although this antiseptic power is necessarily of limited duration, as is the case with all other antiseptics known to surgery. With a greatly enlarged pulp-canal the zinc phosphate preparations can be readily introduced, and of such a degree of consistence as to make a reliable and per-

manent stopping. With a very contracted pulp-canal this is hardly possible.

And just here come the limitations which render the radical procedure recommended by Dr. Atkinson impossible in a very large class of cases; such cases, for example, as the anterior root of a lower molar, or the buccal roots of an upper molar, or the extremely compressed root of a bicuspid tooth, in which the pulp-canal is merely capillary in its proportions, and the pulp itself the finest filament. Clearly, such an enlargement as is here represented is impossible without perforation of the lateral walls of the root. In other cases, while the caliber of the root would permit of the enlargement of the canal, the position of the tooth in the mouth is such that it is impossible to bring a drill to bear in the line of direction necessary to safely effect such enlargement, without destroying an entirely inadmissible amount of the crown of the tooth. These are, however, but limitations upon the execution of what is, in the main, and within due lines of discretion, a good plan. It is well always, where practicable, to enlarge the pulp-canals of putrescent teeth to a reasonable extent, in order to facilitate and expedite the antiseptic treatment, and render the introduction of an impermeable stopping more easy. I am satisfied that very many cases of failure in the treatment of putrescent teeth arise from a neglect of these minute pulp-canals; small as they are they contain putrefactive matter, and are surrounded by a putrefactive zone, and it is exceedingly difficult, if not impossible, to act upon such a canal and root from base to apex by the absorption, vertically, of either carbolic acid or creasote. The tissues are dense, and the line of direction is at right angles with the course of the dentinal tubuli, thus necessitating that the antiseptic agent shall penetrate the walls of each tubulus in turn before the apex can be reached. From such cases, thus treated, alveolar abscess is pretty sure, sooner or later, to result.

These capillary canals, however, are not such obstacles to success when the pulp is devitalized, and the bulk of it immediately removed, and the canal at once filled, because, although filamentous portions of the pulp may remain, they do not undergo putrefaction, atmospheric air being excluded, but are usually absorbed. Never in an experience of ten years have they caused trouble; never during that time have I had an alveolar abscess in a tooth the pulp of which I have myself devitalized and removed, the subsequent stopping of the canal being of course understood.

As a stopping agent in such cases I have always used and still

continue to use the gutta-percha preparations, heating them and packing into the canal with heated instruments. These preparations I find more generally and readily applicable than any others, and I believe that they accomplish all that is necessary in the process as well or better than any other agent; that is, the thorough sealing of the pulp-canal against the invasion of animal fluids from any source. I cannot conceive that gold foil at its best can do more than this, or do it as well. I should as soon think of stopping a bottle with a wad of gold foil as a root-canal. Under all ordinary circumstances the one would be about as rational a procedure as the other.

During this discussion a solution of gutta-percha in chloroform has been recommended as a root stopping, and the claim has been made that it can be forced into the most minute capillaries, effectually sealing them. A great deal can of course be accomplished by practice; but I am a little doubtful of my ability to take a minute portion of gutta-percha solution upon a fine broach and force it against gravity up to the apical foramen of the fine pulp-canal of say the buccal root of an upper molar. It is not so easy to do this with any fluid, much less so adhesive a fluid as gutta-percha solution. Moreover, supposing the canal to be filled with the solution, I should hardly expect to find it fully filled with the gutta-percha after the solvent, the chloroform, had evaporated or undergone absorption. Certainly the chloroform must represent some space, and unoccupied space means to that extent an imperfect stopping. Another danger I should apprehend in the more permeable class of pulp-canals would be the forcing of a minute portion of the solution through the apical foramen. This would be certain to result in inflammation. One of the gentlemen who have advocated this method alluded to this possible complication, but stated that the inflammation resulting was not usually of a high grade. As I have, however, twice seen a very violent inflammation of the root-membranes result from a similar accident with carbolic acid I am a little doubtful upon this point. Carbolic acid would of course be more certain to produce this result, but if any gentleman doubts the highly irritant effect of chloroform when shut up in contact with animal tissue without opportunity for evaporation, he need only try its vesicant powers, under such conditions, upon any portion of his dermal structure he may see proper to submit to the experiment.

Dr. Niles: There is just one word I want to say about the nature of the filling-materials spoken of as used in filling pulp-canals. Dr.

Atkinson, I believe, made the statement that oxychloride disintegrated. I should like to ask the doctor why it disintegrated.

Dr. Atkinson: I did not make that statement. It was made by Dr. Wetherbee.

Dr. Niles: I will direct the same question to Dr. Wetherbee.

Dr. Wetherbee: From two causes, one of which is always present, viz.: the absorption of moisture from the dentine. In the second place, from moisture percolating through the foramen.

Dr. Niles: If oxychlorides are dissolved by the absorption of moisture, phosphates are liable to the same objection when mixed to the consistence of cream, as I believe Dr. Atkinson said he used them. Oxyphosphate when mixed to the consistence of cream forms a product which is soluble in water. That can be demonstrated by any one; and in my opinion that would be an objection to its use in the canal of a tooth. It is very evident that some moisture must come down from the tissue at the end of the root, especially if the opening at the apex of the root has been enlarged. Thus the oxide of zinc and phosphoric acid would become decomposed, and would be useless there as a permanent stopping. The solution of gutta-percha I should think would be more acceptable, from the fact that after the evaporation or absorption of the chloroform, the gutta-percha is insoluble in any fluids that could reach it. The objection which was spoken of by the last speaker is hardly tenable, for in the upper molars the solution would be drawn up by capillary attraction. The canals are very fine in most cases, and the solution is very easily drawn to the apex of the root by this force.

Dr. Meriam: We have heard a good deal of root-filling, and the gentlemen seem to "pick their cases"—those with straight roots, incisors, etc. In practice patients are not so kind, but often have molars with roots so curved that a straight line cannot be drawn from the pulp-chamber to the apex. I do not see how we are to drill to the apex of such roots, following the pulp-canal, or enlarge it to this point with the Talbot reamer as has been recommended. But what I wanted to speak of especially was brought out by the reference made to the difficulty of using gutta-percha dissolved in chloroform, owing to the evaporation of the solvent. We have for some years used instead of chloroform the oil of cajeput. This with heat softens gutta-percha and has all the advantages of chloroform, and also gives all the time needed for manipulation.

Dr. Webb: By opening directly through the crown of a molar tooth each pulp-chamber can be made accessible. Where death

of the pulp has just taken place, or in those cases where the tissue has not become putrescent, the apical foramen should be closed with gold as soon as the bleeding ceases; exudation of blood usually follows the rupture of the vessels at the end of the root by the removal of the pulp. Gold ought to be used for closing the foramen, for the reasons that narrow strips of light foil can be put in place with the certainty of having the air in the pulp-chamber pass out alongside of the piece of foil as it is carefully moved toward the end of the root; the accurate measurement of the length and diameter of the pulp-chamber (which measurement should be taken just before introducing the filling) can be more strictly observed in closing the foramen with foil than in the introduction of oxychloride of zinc or gutta-percha. When, also, foil is placed as near to the end of the root as possible without passing through the foramen, the gold (when carefully and solidly put in place) entirely prevents fluids from entering the pulp-chamber, and this is the most important point about, and almost the entire object in, filling roots. If the foramen be not properly closed, the filling of pulp-chambers cannot well be otherwise than unsatisfactory and the operation an almost useless one. Gold can be used in every case if the operator can reach the end of the root. When a small broach can be placed to the end of a root, even then the foramen can be closed with gold. The pulp-chamber should first be thoroughly cleansed and the foramen then closed with light gold foil, folded once upon itself, or made into three or four thicknesses, and cut into very narrow strips. Cotton is the next best material for the filling of roots. The cotton should be moistened with carbolic acid, and a few fibers at a time be then carefully placed in position at the foramen and be so solidly packed as to prevent infiltration of fluids from the end of the root. Cotton alone can be got to the foramen easier than that which is saturated with oxychloride of zinc, because there is then no oxide of zinc to clog the way.

Dr. Shumway: What objection have you to tin?

Dr. Webb: Tin does not work so nicely as gold foil, and its oxidation is objectionable, especially when placed near soft tissue. One of the reasons for the use of tin as a filling-material is that, where it is not so placed against enamel or dentine as to entirely exclude moisture, the oxidation of the metal fills up the space between the tissue and metal to some extent, and retards, though it does not prevent, further decay. It is far better to make each filling moisture-tight.

It is sometimes necessary to take a fine drill and carefully enlarge the pulp-chamber, but it is better to fill to the end of the root without the drilling. Then, and not till then, the remainder of the pulp-chamber may be filled with oxychloride of zinc, instead of gold, where the operator can be sure to get this material to the gold at the end of the root and get the air out at the same time. The foramen being closed with gold, the oxychloride of zinc cannot pass through to the end of the root any more than fluids can thus enter the pulp-chamber. It is well to use oxychloride of zinc in this manner, instead of gold, in some cases (as in those where the pulp has remained dead in its chamber for some time, and where abscess has taken place), for the reason that the chloride of zinc coagulates the protoplasm and prevents or arrests the decomposition of the ends of the fibers of living matter in the dentinal canaliculi. The foramen ought to be closed with gold before filling with gutta-percha, even when the pulp-chamber is to be filled in the thorough manner described by Dr. McKellops. In closing the foramen each narrow strip of gold foil should be taken on the end of a suitable packing instrument and placed near the end of the root and tapped carefully with a light hand-mallet till the feel and the sound of the instrument indicate that the gold is placed solidly in position. There is less liability of getting gold through the foramen against or into the tissues outside the end of the root by tapping the instrument with a mallet than by placing the foil in position by hand-pressure.

In the treatment of pulpless teeth, and especially those wherein the pulp has been dead for some time and abscess is in its incipiency, or where it has gone on to such an extent as to prevent rebuilding of the tissues surrounding the end of the root, it is sometimes necessary to carry a small drill just through the foramen so as to make a fresh wound and secure healing by "first intention" without inflammation or suppurative action. Japanese bibulous paper, carefully wound around a broach of suitable size, should be used for drying out the pulp-chamber and applying remedial agents. Liquid weeping through the apical foramen should be examined with a magnifying glass, and if the parts of the paper can be clearly seen through the fluid, such fluid is protoplasm from the elements of the tissues about the end of the root. A little deliquesced chloride of zinc ought then to be carried to, but not beyond, the end of the root to coagulate the protoplasm, when the foramen should be closed at once with gold, and the entire opera-

tion may then be completed. If the surface of the paper on the broach cannot be so clearly seen through the fluid after withdrawing it from a pulp-chamber, pus may be looked for and further treatment be required.

In cases where the foramen is so large that it cannot, without great difficulty, be closed with foil, then a gold wire should be fitted accurately by measurement in the end of the root and be carefully put and held in position with oxychloride of zinc; after which the whole pulp-chamber should be filled with the cement. After closing the foramen in each of the roots of molars and filling the greater part or the whole of each pulp-chamber with gold, it is best to fill the bulbous portion of the chamber and a part of the cavity of decay with oxychloride or oxyphosphate of zinc. When this material has hardened, sufficient anchorage ought to be made and the operation completed with gold. When it is necessary to use the pulp-chamber for anchorage, as in cases where a large portion of or the entire crown is to be restored with gold, each pulp-chamber should be filled entirely with cohesive foil, made solid throughout by the proper use (not the abuse) of the mallet. In most cases the gold in a pulp-chamber can thus be made as strong as, and, to serve the purpose intended, better than, a gold wire.

Dr. Shumway: In regard to moisture in the root a little alcohol will dry that all away almost instantly.

It seems to me that the gentleman from St. Louis has said about all there is to be said in regard to root-fillings—in regard to following the canal in the root of a tooth. Nature has made the opening, and it only remains for the dentist to close it if the nerve has ceased to perform its functions. If the canal cannot be reached without enlarging it, then there is no necessity for filling it at all.

I would allow no dentist to drill a hole through the root of a tooth of mine, and I would not do to a patient what I am not willing to have done to myself. An incision from the outside will accomplish all that can be obtained by drilling, and it is perfectly safe. If you drill up through, and then force anything into, the opening, it becomes a foreign body just as much as though it was a sliver of wood in your hand. Nature has got to expel it before there can be a cure. There is no doubt about that.

Dr. Crouse: Suppose you treat the root of an upper bicuspid which is bifurcated, and the palatal root has a sac on its end, and there is no fistulous opening?

Dr. Shumway: I should make the opening from the outside through the alveolus above the root.

Dr. Crouse: Would you not force something through then?

Dr. Shumway: I should make an opening large enough to allow it to discharge its contents. I should not enlarge the opening through the root.

Now, about cylinder fillings: I wish to say I am opposed to the mallet for filling teeth to avert decay. If a tooth is broken off or worn down, perhaps the mallet would not be an objectionable instrument to use to restore it. But this is something entirely different from filling teeth to avert decay. I object to the mallet because I believe the use of it is contrary to recognized natural law. The recuperative process must come from within the tooth. The filling must correspond or be compatible with this process. You strike a tooth with a hammer and nature rebels. If an oculist should say to a patient, your eye is diseased, I will take a mallet and fix it, he would exhibit about as much nerve as the dentist who hammers a tooth because it is decayed. A diseased condition is the same, no matter whether it appears in a tooth or in any other part of the human organism. The process of dissolution is the same in nature everywhere. The treatment for a cure must be based upon the same general law. Cylinder fillings are made up of laminæ or scales. The lamina is adapted to the walls of the cavity, and allows the recuperative process to go on in the tooth. It gives nature a chance to protect itself. Not so with the mallet; when you strike the gold with a hammer its tendency is to crystallize and contract rather than expand, and it becomes illy adapted to its position. It is a direct violation of the law of correspondence.

Dr. Beck: About eighteen months ago I had a patient, a young man of good physique, with no vices (a condition favorable for a happy result), who presented himself with a superior left lateral incisor having a devitalized pulp, and a filling in the lingual portion of it. Upon examination it was evident that there was an abscess at the apex of the root. The filling was removed, the pulp-chamber opened, and a free access to the root-canal obtained; with a Gates drill I followed the canal, and before I was aware of it, the instrument passed out through the end of the root; a copious flow of pus followed its withdrawal. A probe found the edges of the opening rough and irregular. I made the root-canal still larger in order to remove the roughened edges at the end of the root. Then I injected a solution of equal parts of carbolic acid and water; this was done every

other day for one week with no effect; a ten-grain solution of chloride of zinc also produced no result. I then used wood creasote, and after three applications pus ceased to discharge. The case was under treatment six weeks in all.

Dr. Crouse: How many times a day?

Dr. Beck: Every other day. As the parts seemed to heal nicely, I packed the root-canal solidly with carbolized cotton, being careful not to let it project out of the end of the root. I then filled the pulp-cavity in the body of the tooth, and the cavity proper with gutta-percha. It has been eighteen months since the tooth was filled, and it remains comfortable and in good condition. There is no discoloration. There are many cases where gold cannot be used satisfactorily as a root-filling.

The rolling of gold rope-like and cutting it into pellets was taught me by my preceptor, Dr. J. D. White, of Philadelphia, twenty years ago. The comparison between the tooth and the eye made by the gentleman from Plymouth is simply absurd. As for the mallet, I have used the electro-magnetic mallet since its first introduction, and would sooner part with any other instrument than with it.

Dr. Barker: I am in the habit of putting in cylinder fillings. The method of using cylinders is well illustrated by placing cigars in a tumbler, crowding them in at the center, and pressing towards the periphery. The cylinders should be made smaller and smaller, as you approach completion, and the last one used will be very small, and cannot be rolled too hard. After getting in all the cylinders possible, the whole should be condensed with a burnisher and finished in the ordinary way.

Dr. LaRoche: The cylinders you see made here by Dr. Shumway are not properly cylinders. They are shoved together and are what I should call pellets.

The method of making cylinders taught me by Dr. John S. Clark, of New Orleans, in 1854, consists in rolling soft gold foil (No. 4) around a small watch-broach. For No. 0, lay two sheets together; for No. 1, use only one sheet, and for No. 3, one-third of a sheet; these should be folded in straight strips of such width as you wish the length of the cylinders, say from one-eighth to three-eighths of an inch. Before removing the cylinder from the broach the end should be fastened by tucking it under with a small square-pointed instrument. When the whole cavity is properly filled with cylinders, they stand like cigars in a glass, as has been mentioned, and should be pressed together from the center, the space thus made

being again filled with cylinders and the operation repeated until the cavity is full, finishing with pointed cylinders. To make the latter take a sheet of gold-foil, cut into four squares, fold them down in squares to one-quarter or one-half inch or less if you wish them; fold the corners together making a triangle, place the broach in the center of the triangle, and roll it into a solid cone. A little practice will soon teach one just what is needed in the form of a wedge.

At the present time I have my cylinders made by rolling No. 2 and 3 soft foil on a piece of small steel, long enough to roll a whole sheet of gold. I then use No. 4 and 5 cohesive foil around the outside of the cylinder, which holds it together nicely. After withdrawing the steel, I cut the cylinders of any length I desire with a razor. The cohesive gold covering the outside of the cylinder is a great improvement, and the very thin non-cohesive foil on the inside makes a very soft and beautiful cylinder to work.

Dr. Andrews: I know something about Dr. Shumway's method. I have used it in my own practice, and believe it has merit. His manner of rolling cohesive gold is convenient, but these rolls are not cylinders. He uses gold in this form for making the first part of his filling as any dentist would. After a certain portion of the cavity is filled in this way, he cuts a leaf into small squares, anneals over mica, and burnishes or finishes the small square pieces of single thickness of No. 4 gold with ivory points to the filling already begun. By this method he claims that you can get a more perfect adaptation of gold to the walls of the cavity. I do not think Dr. Shumway has made himself clear by what he has said today.

Dr. Crouse: The subject of root-filling has been very thoroughly gone over, and I shall say nothing on that topic, except that I consider it of very little importance what the root of a tooth is filled with, if it is filled to the end, or so that the opening at the end of the root is so perfectly stopped as to shut out all moisture. I wish to call attention to the remarks of the gentleman who preceded me, who said that he knew of no dentist whom he would allow to drill a hole through the end of a root to cure an abscess in his own mouth, hence he would not drill through the end of a root for a patient; that he would not have the mallet used on himself, hence he would not use it on a patient. Now if he will experiment a little on his patients he will find a great many of them will prefer the mallet to hand-pressure. In many cases it can be used with far less discomfort to the patient. Let him try it in some instances

where the pulp is dead, and he will find it good practice. But I wish to speak more particularly of the treatment of pulpless teeth preparatory to filling them. If the roots have an abscess, a cure can generally be effected by forcing carbolic acid through the root and through the fistula so that it shows on the gum. But there is another class of cases that are more troublesome and harder to treat, viz.: where the unhealthy condition exists, but where there is no fistulous opening or chance for the pus to discharge. The plan I adopt in such cases is to enlarge the opening at the end of the root sufficiently, so that if there is any pus there it can escape. I then force an instrument through the opening at the end to cause blood to flow and to break up the fermentation, and, as a rule, the trouble will end without further treatment. I have in mind cases that had given trouble for years, until I enlarged the opening and forced an instrument through, as just described, after which they were well in a very short time without further treatment. In one case, that of a superior bicuspid, the pulp had been dead for many years, and the tooth had been filled on each proximal surface. Being very frail, one of the cusps had broken off up to the gum. I decided to put on a gold crown. Removing the filling from the root, I treated several times and had the patient wear the crown temporarily for some months, but a cure was not effected until I opened to the end of one of the pulp-canals. I found the root bifurcated, and the palatal root had a sac from which pus discharged quite freely. It continued to discharge at times until I used aromatic sulphuric acid freely by forcing it through the opening I had made through the end of the root. After this treatment the tooth was soon well. I believe that in such cases, where the flow of pus will not cease, there is necrosis sufficient to retard a cure, and I know of nothing better to treat with than aromatic sulphuric acid.

I prefer treating through the root to drilling an opening through the alveolus to the end of the root.

Dr. Mills: Suppose the root was filled and you knew the condition of it. How would you proceed?

Dr. Crouse: If I had filled it myself I do not think there would be any abscess. If, however, there was an abscess, and I knew the root was as well filled as it could be, I expect I should drill through the alveolus. But such a case as I have described, of an upper bicuspid with bifurcated root and an abscess at the end of the palatal root, with no fistulous opening, could not be successfully treated through the alveolus, as you would injure one root while

trying to reach the root that had the abscess. One of the speakers who preceded me, in describing a case of alveolar abscess he had treated, told how much treatment he gave it in a given number of weeks. I asked how many times a day he treated it, and he replied, only once in two days; for the reason that his patient lived so far away he could not treat it any oftener. Don't you think it lucky for his patient that he lived a good ways off? Now, he committed what seems to me a very common error, that of treating too much or too often. After giving a case of alveolar abscess one or two thorough treatments, give it a rest, and let nature have a chance to do her part. I have in mind a case that I treated too much. I speak of this case because it is not as common as some. Each of the two superior bicuspids on the same side had a dead pulp, and both were filled. There was a very large abscess, with a fistulous opening, about midway between them and not as high as the ends of the roots. Of course, the first question to be decided was from which root the pus came. Both were a little sensitive to the tap of an instrument. The first had a defective filling in its anterior proximal surface; the other had a good one in the posterior proximal surface. I removed the filling from the first bicuspid, cleansed the root, and filled it with carbolic acid. Having cut a piece of rubber as near the size of the cavity as possible, I commenced pumping to force the acid through the root and out through the fistula. I was almost sure I had commenced on the right tooth, because about the time I commenced forcing the acid the pus began to flow very freely. I think, now, this was caused by some unobserved pressure I made on the gum or the other tooth. It misled me very much. So I worked a long time to get the carbolic acid through, but did not succeed. I did succeed, however, in getting the tooth so sore that I could scarcely touch it when she came again, a few days after. I then concluded I would remove the filling from the other tooth, and told my patient we would try and see if we could succeed as well in making the other tooth sore. I took the precaution this time, however, and have always taken it since, to use some milder medicine the first time. I got my rubber piston ready, having the root open and well cleansed, and used, first, phénol sodique. The first trial it came out through the fistula, driving the pus with it; then I forced carbolic acid through, and the disease was cured without any more treatment. It was six months, however, before the first one got over the treatment I gave it.

A Voice: How many times a day did you treat it?

Dr. Crouse: I treated it several times the first day; enough to give it a rest for some months.

I was very much pleased that the Section on Operative Dentistry presented that paper on soft gold and cylinder filling, for I am convinced that we cannot afford to have that plan of filling go out of use. I am also glad to know that so many dentists, and especially so many of the younger ones, are using cylinders and non-cohesive gold in their practice. I think the profession at large use too much cohesive gold; that is, I think non-cohesive gold is better for stopping decay in ordinary cases and for general use than cohesive. I do not advocate its use entirely to the exclusion of everything else. I think cohesive gold fills a place that cannot be filled by any other material which we know of at present. I used cohesive gold for a time exclusively, most of it number 60; and the fillings I then made, also those made by some other practitioners, at the same time, that have come under my observation, have stood splendidly. This was ten or twelve years ago; so I know that good fillings can be made with it and the teeth be preserved; but I am equally sure as good fillings can be made with non-cohesive gold, and in much less time. The tooth described by Dr. Webb as having a proximal cavity, which he would fill partly with oxychloride and partly with cohesive gold, I believe I could fill with non-cohesive gold, and fill it as well as it could be filled to preserve the tooth, while he was getting it ready to fill with cohesive gold. I am an advocate of non-cohesive gold for filling in general, on the ground that you can save much time and labor to yourself, and cause very much less fatigue and expense to your patients. Some cohesive gold, in connection with the non-cohesive, can many times be used to advantage.

I like the non-cohesive gold at the margins; especially do I want it at the cervical margins of proximal cavities. In such cases I know of nothing better than cylinders of proper size rolled tight and forced up against the cervical margin. I sometimes use several cylinders. I think all the advantage of non-cohesive gold is that it is more pliable, and consequently adapts itself more readily to the inequalities of the cavities.

There is another method which has not been spoken of which I think very much of, and which I have had very good success with, and that is the use of tin foil in back teeth, at the cervical margins of proximal cavities, finishing with gold. Tin being very pliable will adapt itself to the inequalities readily, and where that portion of the

cavity is hard to reach, it is more easily packed so as to shut out the moisture; after which the gold can be added and a very excellent filling made. There is one objection to this mode of practice, however, and that is, if such operations fall into the hands of other practitioners, they, seeing the dark lines which there will always be at the margins where tin is used, are liable to disturb the filling under the impression that decay has taken place above the gold. Excluding the objection named, I believe tin has an advantage over gold used in the way I have mentioned. Being more easily packed, the difficult points to reach are packed quicker and I think surer than in any other way.

In short, I believe it is our duty to operate in the way that is the surest of saving the teeth and that will occasion the least fatigue and expense to our patients.

Dr. Wetherbee: Let us for a moment consider the several forms of gold which are denominated cylinders. The first to be mentioned is rolled upon a broach or any other instrument where the lamina of the gold is preserved, and is cylindrical in form. The so-called flat cylinder is rolled in the above described manner, and then flattened or compressed in one direction. Another way of making them is, first to fold the sheet of gold until quite narrow in width, then fold in squares until you have the desired thickness or quantity of gold. This last form was prepared by Dr. Clark, of New Orleans. The mode shown by Dr. Shumway is denominated "planished;" one piece of gold is laid upon another, and burnished down with ivory points. The proper method to pursue is to adopt such form of gold as will be found best suited to the cavity to be filled. If I have a crown cavity in a right inferior molar, I place my pellet or cylinder against the lingual wall of the cavity, and carry it firmly against the wall, and retain it in position while impaction goes on. Another pellet is placed against the one already condensed, and so on until the cavity is three-fourths filled; then a small pellet is placed at the floor of the remaining cavity, and added to, until the filling reaches nearly the crown surface of the cavity. Annealed foil is then used for completing the filling, and the crown surface is next thoroughly condensed.

The pellets or cylinders have been semi- or surface-annealed, which does not affect the soft working quality of the gold. All cavities may be filled in this manner, having the pellets the size requisite for the cavity.

As to the best method of treating alveolar abscess we have a di-

versity of opinion. It is claimed that an abscess should be reached through the pulp-canal. To facilitate the operation, the foramen should be enlarged to give free access to the part involved, either to an instrument or carbolic acid, or such dental medicine as the operator may prefer. If this method should be considered best for the superior incisors and bicuspids (against which I protest), it is not applicable to bifurcated bicuspids, nor to the mesial root of the first inferior molar.

When the pulp-canal of an incisor is properly cleaned and deodorized and perfectly filled with gold, the abscess in eight out of every ten cases will cease to furnish pus; the sinus will be closed by resolution, and subsequent inconvenience avoided. In patients of a strumous diathesis we have less certainty of immediate favorable results. In such cases I reach the abscess by drilling through the alveolar plate, at such angle as will allow of access to the end of the root, when with a small and delicate instrument the sac may be broken up, and then dressed with chloride of zinc. The sinus should be kept from closing by the presence of a small tent, until pus shall cease to form.

It is important that the filling required should have been completed previous to the treatment above described. If the above method is skillfully applied, you will have occasion to know that the practice of dentistry is not empirical, but conserving the interest of patients, long suffering, perhaps, but now honoring the profession.

With reference to the planishing method, every man has a right to his opinion, and to work in his own way. I concede to Dr. Shumway this right. It is required of him and all other practitioners that the results obtained shall be up to the point of excellence demanded. If there shall be failure in that direction, his intelligence should stimulate him to adopt such modes of practice as shall secure the highest possible attainments.

His (Dr. Shumway's) objection to the use of the mallet arises from his excessive effeminacy. He is supposedly always on the soft side of this question. If I am to fill a tooth of a delicate structure, I prefer the mallet, because my touch with it is as delicate and tender as my neighbor's hand-pressure who does not know how to use the mallet. If I understand my malleter and he understands me, the gentle touch of the mallet is no objection at all to the delicacy of the enamel, but its defense.

When I first used the mallet my patients objected to it from a false theory of its use. Now forty-nine out of every fifty would

rather have my gentle malleting than hand-pressure. With the mallet you never slip; with hand-pressure there is a possibility, even when the greatest eare is used. I profess to be master of both modes of practice. I know what non-cohesive gold is, and how to work it; it works in my hands as kindly as eohesive foil.

Dr. Shumway: In regard to root-filling, I simply want to mention a ease that eame to my notice only last week of a root that was treated and filled in Chicago reeently—a left lateral incisor. The nerve-eanal was drilled out through the apex according to the method recommended, and then the gold was malleted with such force as to drive the gold through the opening. Of eourse this foreign body caused an inflammation and ulceration worse a hundred-fold than the one it was intended to cure. In a little while a pieee of gold eame through from the outside and left a large opening.

Dr. Palmer: Dr. Crouse alluded to a combination of gold and tin for filling, with regard to which I wish to make some remarks, based upon practice and close observation. For a period of over seven years I have been trying to work up something by which to preserve teeth where amalgam would not be admissible, for we have cases where we would not use the latter; besides in a certain class of teeth, neither gold alone, nor amalgam, is the best material to use. There are two conditions which militate against the use of gold alone, one of which is controlled by chemical laws, the other may be regulated by the dentist and his patient. The latter is where economy is essential. It is not the fortune of all patients to be able to pay for gold. If teeth can be preserved within the means of patients who cannot pay for gold, it is the duty of the profession to provide sueh fillings. Regarding the first condition, I wish to mention where gold is not compatible with tooth-bone. The teeth contain twenty-eight per cent. of cartilage and conducting matter, and seventy-two of lime-salts, or non-conducting elements. We all know that variations of these proportions give various densities of the teeth. Teeth of even lower density than this standard are preserved with gold. From the lowest grade to the highest within its range of preservative power, gold is unquestionably the best material of which we have any knowledge. My position regarding it has been from the first that it should be used whenever and wherever it will preserve the teeth. In teeth below a certain standard of density, the combination referred to will be found more eompatible with tooth-bone than gold; and in many cases less objectionable than amalgam. Dr. Crouse introduces the tin at the eervical base, whieh

was my method for several years. If but one or at most two layers of tin-foil be used as a lining, all right, but the soft condition of teeth often renders it necessary to fill a considerable portion of the cavity with tin, and finish with gold. Whatever the quantity of tin used I find it better to use it in combination with gold in alternate layers; the former method of rolling two sheets into a rope is quite apt to bring two or more thicknesses of tin together; the result is that the tin is liable to be dissolved by galvanic action and washed away, so that the surface of the plug will show depressions; whereas, if an equal amount of gold is used, or rather when but a single layer of tin comes in contact with gold, the two metals form an alloy as if fused together. When used in this manner, no such depressions occur; the gold preserves the tin. This molecular change takes place only at short distances, so I find that whatever amount of tin is used it is best to arrange it in alternate layers with the gold, which may be done by placing a sheet of gold upon a sheet of tin. Four leaves—two sheets of each—give a fair thickness; these may be cut into strips or blocks, as desired; the cutting fastens the edges. Whole plugs made of this combination are often as hard as amalgam, preserve the tooth the same as tin, and discolor the dentine no more than tin. Fillings may be made rapidly, as it works better than gold or tin alone. I would say here, that for large crown cavities in molars, I should rather first fill the cavity with oxyphosphate, and then cut away and finish with gold, because the oxyphosphate is a non-conductor as compared with a metal.

SECTION V.

Anatomy, Histology and Microscopy.

Reflex Action and Shock in the Dental Specialty.

Paper by E. S. Niles, of the Section.

THE part which reflex action plays in the physiological and pathological phenomena of the system is a subject of growing interest to medical specialists.

How often are the various systemic derangements in these busy, active American cities traceable to an over-worked or shattered nervous system.

The increase of the insane, eccentric, peculiar classes of people, and the consequent call for neurologists and nervous hospitals, urge upon us the necessity of a more thorough knowledge of the excitants of movements and functions of life, that it may be known what is compatible to the elements that sustain these forces.

Very little positive information is given us in the schools or text-books, and the field of study is somewhat barren.

The general divisions of nervous matter are being gradually mapped out, and before many years we shall be in possession of the location of the various centers or stations and the fields they control.

But the ultimate nerve-fiber and its mode of termination in the ultimate muscular fiber and origin in its center; the relation of one cell to another, or the intercellular substance; what the impulse is that is generated and proceeds like electric force along the nerves, and how it imparts life and action to the muscles and organs, are not yet determined.

These questions require a knowledge of the chemico-vital or molecular change which takes place in nervous protoplasm, about which present theories are but mere conjecture.

Out of the most plausible theories the writer of this paper has tried to draw some practical conclusions which may be of service to us; with no pretensions of originality except, perhaps, the presentation of the subject with reference to our specialty. What then is reflex action?

It has long been known, from experiments upon animals and decapitated criminals, that severing the head from the body does not wholly arrest muscular activity, and that under this condition action is governed by the spinal cord; for if this nerve-center is destroyed, muscular activity is at rest.

The ganglia or gray matter of the brain and spinal cord, and all ganglionic centers are regarded as giving rise to, or transforming impulses received through the sensory or afferent into impulses recognizable by the motor or efferent nerves. The white matter of the spinal cord performs a different office, independent of the local ganglia or of those ganglia that are involved and serve like nerve-fiber simply as conductors, connecting the higher with the lower centers. Thus, when the brain wills a movement, the cord may act simply as a conductor connecting the cerebral centers with the voluntary muscles brought into action; or when a habit is formed, as in the act of locomotion, the cord acts as a generator of stimulus to produce the action of the muscles of locomotion, and may receive, transform, and transmit nervous impulses.

The movements produced after the head is severed from the body are independent of sensation and volition, and may be called purely reflexed action, being reflexed back from the ganglionic structure of the cord.

The term "reflex action" may then be applied commonly in connection with a generation of nerve-force which occurs independent of the will.

Reflex movements, stimulated from the cerebro-spinal axis, are so intimately associated with the will that we seldom distinguish them from the voluntary; for instance, the man who fluently addresses an audience is employed with the thought of his subject, while the muscles of speech and articulation are, for the most part, presided over by lower centers; and the muscles of locomotion are usually governed in the same manner, in proof of which we know that people walk in their sleep, and postmen have walked distances of a mile and a half. We see the same muscles brought into use and the same actions as by the will. When during infancy we learn to walk, each step is carefully watched and directed until the

nerve-centers subordinate to the will have acquired the power of stimulating and governing these muscles.

The pianist first governs his fingers by the will, but the accomplishment is perfected in the acquirement of the power of concentrating the mind upon the effect, while the so-called "educated hand" wanders, almost without mental guidance, over the keys.

Respiration is for the most part reflex; its center has, I believe, been located in the medulla. Impressions upon the special senses —sight, hearing, smelling, tasting, feeling—may give rise to certain trains of thought by reflex centers.

Those movements which may be reflex or voluntary are mainly governed by nerve-centers situated in the cerebro-spinal axis.

Coming down lower in the scale of nervous action, we have what may be called a reflex system, commonly known as the sympathetic, which is made up of isolated ganglia intimately connected by nerve-fibers, so that a knotted net-work is formed and distributed through the visceral and various other cavities of the body. It differs anatomically from the higher system, in that its ultimate fibers are smaller, and the cells are characterized by the frequency with which they send out single prolongations. Those of the spinal system have six or eight, and sometimes more, filaments running from them.

The office of this reflex system is to preside over the functions of circulation, secretion, excretion, growth, and repair.

The more thickly clustered bodies of nervous matter or little brains are termed ganglia. Thus we have the cervical sympathetic following the course of the carotid artery; a thoracic and semi-lunar and various other little ganglia situated along the numerous arterial and nervous lines of the body.

To this system, especially, are due the constant and silent impulses that are always being sent out, whether we are asleep or awake, to stimulate and control our lives.

It is not yet conclusively proved by actual dissections or from the physiological standpoint, that there exists a system of nerves which directly preside over the nutrition of a part, called by Dr. Marshall Hall, excitor-nutrient and excitor-secretory, or trophic nerves.

No one will doubt that these processes of life are directly or indirectly under the control of the nervous system.

The existence of a vaso-motor system was conclusively proved to me by Professor Bowditch, of the Harvard Medical School; and as these nerves have the power of lessening or increasing the quan-

tity of blood to a part, they must indirectly exert a trophic influence upon the parts supplied. The vaso-motor system is distributed to the muscular walls or coats of the arteries.

The supposed trophic nerves would necessarily be distributed to the organ, enabling it to take from the blood just the kind of nourishment it needs. Thus the osseous system takes bone-forming material, muscle largely nitrogenous or albuminous substances, fatty tissue carbonaceous substances, and so on; the hair, nails and each tissue selects just the nourishment it requires for supplying its waste. The power in the organ to do this is said by some to be due to nervous influence.

Still lower in the scale of animal life is found automatic action, which has more or less local influence over the organ in which it is located.

The heart of a frog furnishes a good illustration of this mode of movement, as it is found to beat regularly for some time after entire removal from the body.

Cilia, spermatozoa, and the lower orders of animal life furnish the main source for the study of this form of action.

The duration of this mode of exciting action is much shorter in warm than cold-blooded animals; thus the study is rendered difficult, and its office is not well understood. In a physiological point of view, then, we may say the generation of nerve-force is derived from four sources:

1st. The will, the highest form of nerve-force.

2d. The higher reflex centers, embracing the whole cerebro-spinal axis.

3d. The purely reflex or sympathetic system, which controls the involuntary muscles, as those of the arteries and viscera, and movements stimulated by the sporadic ganglia of the thorax and abdomen, over which the will has practically no control.

4th. Automatic centers found in the organ itself, which may influence its function after entire separation from the body.

These four distinct exciting sources of the phenomena of life, although in a physiological point of view independent in some respects of one another, yet in the fulfillment of their office, their fibers are found to be so intimately associated, and ganglionic interchange of fiber occurs so freely, that it is hardly possible for one system to be stimulated to excess or to a great extent without affecting other centers. The nerve-fibers from the higher ganglia communicate with the lower, and the lower with the higher, with both sen-

sitive and motor trunks also accompanying each other to different stations or organs, the difference in the movement or peculiar function being in proportion to the number of nerves received from each system.

Thus a two-fold channel of communication is established between different points of the body, through the medium of nerves, cells, and intercellular substance, connecting the organs of the interior with the peripheral portions of the body, and through the channels of our special sense with the external world.

It is hardly necessary before an intelligent body like this, to call attention to the practical bearing of this subject upon our daily operations; but I beg your forbearance while I make a few applications.

In view of the intimate association of the parts of the oral cavity with the cerebro-spinal centers, not only through the five senses, (sight, taste, smelling, hearing, and feeling) but by osseous communication—so nicely illustrated by the audiphone—the practical conclusions are obvious in connection with our specialty. We come, then, to consider the question of shock in dental practice.

No one will doubt, that in nearly every operation there is a degree of exhaustion on the part of the patient after visiting the dentist; in degree, according to the nervous susceptibility of the person or time employed in performing the operation, pain inflicted, etc. And I wish briefly to direct attention to the various sources of this exhaustion or shock as they have occurred to me thus far in my practice.

The sight of our best cast-iron dental chairs, various smells about the dental office, the dental engines, with large heavy hand-pieces, which preclude the possibility of delicacy of touch. In my opinion, the flexible arm of the White engine will admit of a more delicate touch than the Johnston or Bonwill.

The various complicated electric or engine-pluggers are most admirably adapted to produce shock, especially in long operations. These are liable to have their accompaniments of ingenious power, water, steam, or electricity, which add to the bewilderment of the poor victim. Coarse-granulated corundums, sand-paper, and heavy burs, you all know may also be used at various times.

I have some fault to find even with our hand excavators and pluggers.

It is known to all of us that the more delicate or flexible the excavator or instrument, the more gentle will be its contact when we touch a tooth.

"Cold steel" imparts a disagreeable sensation in proportion to the amount of metal in the instrument, and as little of it as possible should be employed in making dental instruments. The old way of making not only pluggers but excavators with handles of wood is more in keeping with the gentle and kind treatment which not only our patients but nature's laws demand from the members of our specialty. These ideas point strongly, but I trust not too strongly to the "new departure." There is a wide distance in treatment between the man who pounds cohesive gold and the other extremist who uses exclusively plastic filling-materials, and it is my opinion that those who find the "happy medium" will reap the greatest reward.

I have passed an important point which properly comes under the heading of this paper, and that is the various constitutional derangements, chronic or temporary, that affect our specialty.

These may be classed as those that diminish the vitality of the pulp of a tooth, and those conditions which affect the tooth locally, as an increase of temperature of the mouth which naturally would be followed by stronger acidity; or the chemical composition of the saliva may be of such a nature as to throw down abundance of lime, mucus, etc.

All these often are the result of primary systemic causes, and the local manifestations with which we are often called to deal are but the reflex effect brought to our notice by this wonderful telegraphic system of ours.

The length of my article does not admit of following up these thoughts as far as facts warrant at the present time, but I trust enough has been said for the thinkers that may take the trouble to follow beyond.

SECTION V.—Continued.

The Present Status of Dental Histology.

PAPER BY C. F. W. BÖDECKER, OF THE SECTION.

FOR more than thirty years the cell doctrine was regarded as the basis of Histology. The founder of this theory was Th. Schwann, who, in 1839, announced that animal bodies as well as plants are built up by extremely minute vesicles, the so-called cells and their derivatives. This doctrine was greatly improved in 1850 by Rudolph Virchow, of Berlin, who, like Schwann, considered the elementary vesicle to contain a driblet of liquid with a nucleus suspended therein. This was thought to be the ultimate morphological element of the animal body. The liquid in the vesicle was regarded as the seat of life, and the point from which all multiplication or proliferation of the cells originated. In 1862, the cell doctrine was considerably modified by the late Max Schultze, of Bonn, Germany. This excellent investigator claimed that instead of a vesicle holding a fluid, there existed a jelly-like mass forming the body of the cell, and to this he applied the name, originally used by the botanist Von Mohl, "protoplasm." This substance, up to the beginning of the present decade, was regarded as a structureless mass, inasmuch as neither nucleus nor the granules which are scattered throughout the substance were considered essential features of living protoplasm. In 1862, L. Beale, of London, accepted the doctrine of Max Schultze, but by staining the specimens with carmine, he arrived at the conclusion that only the nucleus and nucleolus of the cells are living or "germinal matter." The jelly-like mass around the nucleus, as well as in the gluey basis-substance of the connective tissue, muscles, and nerves, is described by him as formed (dead) material.

In 1872, the doctrine of histology as accepted by the leading histologists was as follows: The animal body is composed of innumerable minute cells, which are built up by a "structureless," mostly

nucleated protoplasm; these cells being either suspended in a liquid (the plasma of blood, lymph, saliva, etc.), or inclosed in a jelly-like or more or less consistent intercellular substance, separating the cells from each other. It was also believed that direct communications of the cells with one another only existed in the myxomatous connective tissue, the muscles and nerves being regarded as derivatives of cells; thus, the source of these most active tissues of the body was thought to be a combination and fusing together of isolated cells.

It is obvious that, according to this view, the animal body is a compound structure of individual cells built up like a dwelling, the single bricks representing the cells, and the mortar between the bricks the intercellular substance.

In 1873, Carl Heitzmann, of Vienna, now residing in this city, established a new doctrine, which Louis Elsberg, of New York, has proposed to call "bioplasson doctrine." Heitzmann discovered a reticular structure in the protoplasm, and described the nucleus, the granules, the uniting threads, and also the inclosing layer around the protoplasm as the living matter proper, which is exclusively endowed with the capacity of motion and growth. The liquid, however, which is held within the meshes of the reticulum, he declared to be devoid of life. The elementary form of living matter is announced by C. Heitzmann to be a homogeneous, apparently structureless granule, of which sometimes hundreds may be seen in the small lump of protoplasm formerly termed a cell.

A second discovery by the same author is that all the tissues of the body and the formerly so-called cells, are connected with one another either directly, by broader offshoots, or indirectly, by a delicate reticulum of the living matter traversing the basis-substance. Isolated lumps of protoplasm are not met with except in the liquids of the body, such as blood, lymph, etc., which are not entitled to the name "tissue."

By the foregoing discoveries, the cell doctrine is changed entirely. Instead of pronouncing the animal body to be a mere compound of individual cells, we now have to consider it as one continuous mass of living matter, which contains within it closed spaces more or less occupied by liquids (the blood, lymph, etc.) In other words the animal body may be compared to an engine in which all the constituent parts are in uninterrupted connection with each other in order to enable the whole to perform its duty.

To-day, the presence of the reticular structure in protoplasm is

accepted by most of the leading histologists both in Europe and America. I refer particularly to the recently issued atlas of histology, by J. Klein and Noble Smith, of London, wherein the reticular structure is considered an established fact, and full credit given to its discoverer. In 1879. A. Spina, of Vienna, discovered a new method of preparing specimens of cartilage for microscopical investigations, namely, a particular treatment with alcohol, which enables anyone to observe the direct, as well as the indirect offshoots connecting the cartilage-corpuscles. In 1880, S. Stricker, of Vienna, observed that the protoplasmic bodies in the cornea were neither migrating nor isolated cells, the basis-substance of which may change again to protoplasm by assuming a reticular or a fibrillar structure, but that the basis-substance and the cornea-corpuscles were one continuous structure which, under certain circumstances, might assume the properties of either of them. Analogous observations by this same observer have been made on the epithelium of the cornea.

How, then, does the old cell doctrine stand in regard to the hard tissues of the teeth? Can the formation of dentine, enamel, cementum, secondary dentine, or a reformation of primary dentine be satisfactorily explained by the cell theory? The various stages of an inflammatory process—of which, since the excellent researches of Frank Abbott, caries is recognized to be a lower form—cannot, to my mind, be more clearly described by any other doctrine than the bioplasson. I am thoroughly convinced, gentlemen, that as long as you adhere to the old cell doctrine, you will not be able to realize the various physiological and pathological changes of the dental tissues.

In 1874 C. Heitzmann established in this city a histological laboratory, where his discoveries are demonstrated, and under his direction I have, during several years, very carefully studied the dental tissues, the results of which have appeared in a number of issues of the *Dental Cosmos*. They are in full harmony with the bioplasson doctrine in general, and as most of you, gentlemen, are not fully acquainted with them, I propose to recapitulate very briefly what I have found.

The lacunæ of bone-tissue are cavities within the glue-giving basis-substance, containing a protoplasmic body with a distinctly visible reticular structure, the latter to be regarded as the living matter of the protoplasm. In the basis-substance of the bone we find the canaliculi, which communicate with each other as well as with the

lacunæ. Between the canaliculi the basis-substance is pierced by an extremely delicate net-work, and only the very minute meshes hold the calcareous salt. The protoplasmic bodies present in the lacunæ send offshoots of living matter into the canaliculi. From the protoplasmic bodies situated within the lacunæ there are visible delicate conical offshoots, which, with their pointed extremities, are directed towards the finest canaliculi, where they are lost to sight.

The structure of the cementum is identical with that of bone, namely: It contains protoplasmic bodies within the lacunæ, offshoots of living matter in the canaliculi, and an extremely minute reticulum traversing the basis-substance.

On the neck, teeth present peculiar arrangements. The dentinal canaliculi, as well as their tenants, the Tomes fibers, do not quite reach the boundary of the dentine, but stop short of the cementum, where they end in a somewhat coarse net-work. In this vicinity no bone-corpuscles are present in the cementum. It is built up by spindle-shaped protoplasmic bodies imbedded in a coarsely granular basis-substance. By the presence of this superabundance of living protoplasm, the greater sensitiveness of the necks of teeth may be explained.

The canaliculi of the dentine as a rule are bifurcated only on the boundaries toward the enamel and cementum. Each canaliculus contains a central slightly beaded fiber of living protoplasm, which, on its whole periphery, is beset with delicate conical thorns. The basis-substance of the dentine, like that of bone, is pierced by a very delicate reticulum which connects all the dentinal canaliculi indirectly with one another, and which evidently contains living matter.

The enamel exhibits fibers of living matter identical with those of the dentine, but not so large. The fibers lie in the interstices between the enamel-rods, and upon their periphery we see the same thorn-like projections as upon the Tomes fibers of the dentine. The enamel-rods themselves show an extremely delicate net-work, which, under peculiar circumstances, has been brought to view in specimens prepared by Frank Abbott.

In the pulp all protoplasmic bodies of the periphery, as well as those imbedded in the myxomatous or fibrous basis-substance are united with one another, either directly by larger offshoots, or indirectly by filaments through the basis-substance.

In this way all formations of living matter, of the dentine, enamel, cementum, and the pulp are uninterruptedly connected with one another, by the surrounding pericementum with the bony socket,

and thus with the whole body. Hence, a tooth is composed of a series of wonderfully complicated living tissues, being a constituent part of the animal body, and is neither a compound lump of isolated cells, nor a dead mass of lime-salts.

SECTION V.—Continued.

Etiology of Chemical Abrasion of the Cutting-Edges of the Front Teeth.

PAPER BY ISAAC B. DAVENPORT, OF THE SECTION.

THE cause of chemical abrasion affecting only the cutting-edges of the front teeth has never been satisfactorily explained in any of our literature that I have been able to find upon this subject.

The condition itself is well illustrated and described in Harris's "Dental Surgery," under the head of "Spontaneous Abrasion," and is well shown upon the model which I will pass for your inspection, where you will notice that only the upper incisors and, to a slight extent, the canines are affected.

Sometimes the abrasion involves both the upper and lower teeth, and when fully developed leaves an elliptical space which exactly corresponds with the boundary of the labial commissure when open, as during ordinary conversation, or as in the natural position of those who have the habit of going with open mouths.

The cause of this form of abrasion Harris is inclined to attribute to acidulated mucus, which he supposes to be secreted by a mucous gland, which Dr. Nuhn, the German physician, claimed to have discovered in the tip of the tongue.

Good authorities have denied the existence of this gland.

If the theory of Harris is correct, the abrasion ought always to affect the lower as much as the upper teeth, which is not often the case; besides, the lingual and palatal surfaces ought to be most acted upon, at least during the progress of the affection, but just the reverse is true, for it is the labial surfaces that are *first* and *most* affected, as will be seen on the model before you, upon which the labial surfaces are worn much shorter than the palatal.

No longer ago than February, 1878, a paper was read before the Alumni Association of Philadelphia Dental College in which this condition was described. The conclusions of Harris were simply repeated, and no further light was thrown upon the cause.

In the second number of the *Ohio State Journal of Dental Science*, the editor, in reply to the query, "If in chemical abrasion or corrosion the abrading agent is recognized," answered, "Yes; lactic and acetic acids," basing his conclusions upon the following reasoning: "In abrasion the surface is left clear and clean, the organic and inorganic matter being removed to the same extent. This proves that the abrading agent forms soluble compounds with all tooth-substance, otherwise débris would remain. It also proves that the corrodent dissolves the two kinds of tooth-material with equal facility, for they are dissolved and washed away to exactly the same extent."

He says further: "Of all known acids but two have the necessary solvent powers above described; these are lactic and acetic acids, and these have the power only while in the nascent state."

While this may well explain that denuding process which we sometimes see on the labial surfaces near the gum, it is *not* a complete explanation of abrasion of the *cutting-edges;* for while *these* acids may cause this condition, they are not the *only* acids which do it; nor is it necessary that the corroding agent be one that removes equally the organic and inorganic constituents; for if *any acid* which dissolves lime-salts be brought into contact with the cutting-edges of the teeth, the same result will follow, viz.: a smooth, abraded surface; because the soft organic materials will be polished away by the food, lips, and tongue as fast as solution of the inorganic elements advances.

In 1875 the following case was noticed, from which the model now in your hands was made.

It was that of a man twenty-nine years of age, of robust physical development, with teeth of excellent quality, there being no decay in any of the upper teeth, although some of the lower molars had been lost. The superior central incisors were worn away one-half their length, the laterals to a less extent, and the canines a very little; the other teeth were not affected. Thus a wide space was left between the upper and lower incisors when the teeth were closed. No teeth could be seen during conversation, as they were worn away even with the line of the lips. The lower teeth, being completely covered, were not affected.

Up to eight years before, the patient had lived upon a farm, and at that time his teeth were perfect. He then engaged as a workman in the manufacture of nitric acid and oil of vitriol, when, to use his own expression, "the gases escaping from the retorts set his teeth on edge, and he soon noticed that they were wearing away."

He also stated that the teeth of all the other workmen were more or less affected, according to the extent that they were left uncovered by the lips; in some both the upper and lower teeth were involved.

The patient stated that the entire wearing away of his teeth had been accomplished within six months after entering the factory, during which time the abraded surfaces were sensitive to touch, heat, and cold.

When seen by me there had evidently been no progress of the affection for a long time, and the teeth were free from sensitiveness.

One month after the above case was noticed, another appeared in which the abrasion was in progress. The patient, a man about thirty-five years of age, had for a short time been employed in Professor Mowbray's nitro-glycerin works, where nitric and sulphuric acids were manufactured and used in making nitro-glycerin.

The labial surfaces of both upper and lower incisors were worn away one-half their length, being beveled off from a point corresponding to the line of the lips, to the palatal surface, and involving the cutting-edge; but as yet the shortening was only slight. The patient said that "most of the wearing had been accomplished within two weeks after entering the factory, since which time, he had learned to keep his mouth closed while at work. Some of the workmen protected their teeth by wearing thin pieces of gutta-percha molded upon their labial surfaces."

In all the cases I have seen or investigated, there had been exposure either to the fumes of nitric acid alone, or to nitric acid and oil of vitrol. The fumes developed in the manufacture of nitric acid are nitric oxide, which, coming in contact with the moist surfaces of the teeth during respiration, forms nitric acid. Oil of vitriol is a mixture of sulphuric acid and sulphuric anhydride, the former being non-volatile, but the latter is highly volatile, and this uniting with the moisture on surfaces of teeth forms sulphuric acid.

In a communication from Prof. Chas. Mayr, chemist, of Springfield, Mass., well known to you as a writer upon scientific subjects bearing upon our specialty, he says: "It is easily explainable in your cases, why *just* the incisors and canines were cut off. A person

breathing through the mouth must necessarily draw the acid air over those teeth and the acid condenses upon them, dissolving the lime-salts, and the food, tongue, and lips slowly remove the softened tooth-substance. The molars do not come much in contact with the acid air, first, because the greater part of the acid fumes have been absorbed and neutralized by the incisors, etc.; second, because the stream of air rushes straight from the mouth to the trachea without reaching the remote corners."

"Vapors of volatile mineral or organic acids when inhaled through the nose are quickly neutralized and have no effect on the teeth." "This action, erosion and solution of the teeth by acids, is well known to chemists, and we keep our mouths closed when experimenting with acids." "The destructive agent in these cases is not any *peculiar* acid, but *any* acid, provided it is volatile."

Prof. Mayr also mentions another essential condition for preservation of the teeth in an acid atmosphere, viz.: "That the lips be dry, as on moist lips acid vapors will condense, and upon opening the mouth be brought into contact with the incisors and canines, and the same results follow as when the fumes are inhaled."

From the foregoing considerations, may we not safely conclude that the etiology of chemical abrasion of the cutting-edges of the front teeth (or the so-called "spontaneous abrasion" of the older writers) is the direct contact with the teeth (by inhalation) of any *acid*, mineral or organic, which is capable of dissolving lime-salts?

DISCUSSIONS ON REFLEX ACTION.

Dr. Bödecker: Dr. Niles is not quite well-informed as to the nervous supply. The gray matter, or axis cylinder, is continuous from the nerve-center to its termination, and is enveloped in the white substance of Schwann. Dr. Niles stated also that the nerves are intimately connected with the ultimate muscular fibers. I have never seen it. The nerve enters the myolemma and there is lost to sight.

Dr. Atkinson: I would ask what reflex action is understood to be by those who use the term so freely. I have never seen any definition that was satisfactory to my mind, so as to enable me to comprehend the origin and terminus of an impact of energy that could be called reflex action, unless all the physiological actions of the body are not carried on by that very process. I think this is a field as yet nearly unexplored, that will have to be comprehended and

wrought out before we shall be masters of this question. We say we understand the nervous system, and yet we have different views put forth by different physiologists in the text-books, and we see much difference of understanding of what is perceptible under the microscope as to the distribution of the nerves. As far as I understand it, the sensory or motor nerves have no characteristic definition under the microscope as to the manifestation of their functions. Dr. Bödecker said, what I have seen and have never known in the mammalia to be different, that the interior of the nerve, after losing the cylinder of Schwann, enters into a sort of basis-substance; that point has not been decided,—whether it is nerve or not. I have had the temerity to call all that tissue neural mass or nerve mass. It has been called by some protoplasm; and I think it is not a very great mistake to say it is protoplasmic basis-substance at least. Now, if we take into view the function of the mollusca, which are white-blooded animals—the jelly-fish, oyster or mussel, or clam—we shall learn that there is a circulation there as clear and distinct as blood circulation; endowed with blood-corpuscles and fluid blood, and that the tension between the central and peripheral sinus keeps up the circulation. I take it that this is the secret of reflex action, and that what the power is that produces it has yet to be discovered. We may guess at it, and talk, as we think, very learnedly about it, as we hear *ad nauseam*. When everything and anything abnormal takes place, every one says it results from irritation, without defining what the irritation is. I take it that "irritation" is the disturbance of the balance of tension of the circulation between these blood islands—shall I say they are blood cavities? They are sinuses in which the blood is held in large lake-like conformations, and whatever that tension is between them that keeps up a round of circulation, is the basis of our reflex action. It is well known that when a motor nerve is cut nearly off, spasm of the muscles to which it goes is induced (and some of our dental associations, probably, are very much exercised by what is called reflex action), which cease once when the remnant of the nerve, that does not seem able to convey this tension, is cut. I am not saying this in any other spirit or any other hope than as putting up a finger-board towards the direction from which I hope an answer may come, but at the same time I want to say,—it may be through my ignorance, —that I have never heard reflex action satisfactorily accounted for by any physiologist, and I have never read of it in any book, and yet I have memorized a good deal, and I have known others who memor-

ized a good deal that has been written on that subject. Hearing, seeing, tasting, smelling are all instances of reflex action, if not, indeed, every one of the secretory actions of the body and all molecular changes. You are, all of you, aware of the effect of any savory substance addressing consciousness through your sight, causing a flow of saliva, adapted to dissolve that special substance from which that odor arises. If it is from the eye, you judge from past experience. In investigating these subjects it has been said, that substances with which we are not acquainted, but which act upon us when brought in direct contact, do not excite reflex action. I say this to show how very careful we should be in attempting to account for appearances, by only mentioning a few of the facts that have fallen under our observation. I am very fond of facts, and am very fond of the records of facts, but I am very much more delighted with correlating these, inasmuch as consecutive order is the relative beginning and ending of the process that we call reflex action.

Dr. Barrett: In the discussion of the subject of reflex action, or of nervous activity, of nervous force, it is important that we have a definite starting-point. We must first determine what is nervous force; what is its origin, and thence endeavor to trace out the laws which govern its manifestation. To do this we must go back to the origin of all force, and that is, indeed, getting at the roots of things. It underlies all phenomena of whatever kind. It is believed at the present day that light, heat, electricity, and chemism are but modes of motion; that they are but the result of certain molecular changes which are continually going on; that they are mutually convertible, the one into the other. The electric light, which is even now illuminating the street outside this hall, is an example of the conversion of electricity into light, or it is another mode of manifestation of the parent and unit, force. In the galvano-cautery we see electricity converted into heat. In the galvanic battery we see chemism converted into electricity. In the thermal pile, heat is converted into electricity, and thus it may be seen that one force is readily converted into another. Nervous force is but another mode of this manifestation, for why should we say that the law is general and holds good through the lower planes of force, and that it fails us when we come where we most need its application. If an animal be anesthetized and the pneumo-gastric nerves exposed and raised upon the point of a glass rod, and if we now after opening the thorax and exposing the heart, apply the poles of a battery to the pneumo-gastrics, all the phenomena of life will be observed, even though the

animal be quite dead. The heart can be made to dilate and contract, its systoles and disastoles observed the same as under nervous impulse; and what is this then but the conversion of electricity into nervous force? It cannot be said that it is the direct power of electricity acting upon the muscles of the heart, for there is here no closed current. Again in the gymnotus, the electrical fish, the special apparatus which is the source of the shocks is evidently a part of the nervous organization. Light does not differ from heat, nor heat from electricity, except in the mode of manifestation. It seems to me quite as evident that nervous force is dependent upon, and has its origin in, the molecular changes constantly going on in the body, and that it is but another manifestation of that parent force which in other forms we call heat, light, electricity, and chemism. It is more complicated in manifestation than they, but that does not alter its character. It is that mysterious thing which we call life, vitality, the ghost, the soul.

Dr. Buckingham: I do not know that I can throw any light on this subject. It is one of the most difficult subjects with which we have to contend. The theory of some is that forces are entities and can be changed one into another; others regard them as nothing but motion. Allowing them to act by motion, how can we conceive of motion originating itself, and how can we explain motion being changed without some force to change it? What is that force? Where does it come from? How does it act upon matter? Can we conceive of anything that will move but matter? You all know that in order to explain light as a series of motions, we have to conceive that space is filled with a substance called ether. We cannot prove that the ether exists, and we cannot explain motion unless there is some material substance to move. It is calculated that the atmosphere extends about forty-five miles above the earth, and the sun is over ninety millions of miles from us. Now, there must be something in this vast space between the sun and our atmosphere to move, if light is nothing but a series of motions; hence we must adopt this theory of an ether, or else say light is an entity, and is projected out and passes through space.

Oersted, more than half a century ago, advanced the beautiful idea that "The laws of nature are the thoughts of God." When we endeavor to explain some monstrous process, we select some analogy which we can understand, and I think we may illustrate the natural force by referring to our civil laws. Blackstone, more than a century ago, explained laws to be "that rule of action which is pre-

scribed by some superior being, and which the inferior is bound to obey. Thus, when the Supreme Being formed the universe and created matter out of nothing, he impressed certain principles upon that matter from which it can never depart, and without which it would cease to be." When he put that matter into motion he established certain laws of motion to which all movable bodies must conform. I am not going to give a lecture on theology, but whether we believe or not in a creation as described in the Scriptures, or in some other mysterious way that we cannot explain, the fact still remains that we have matter and force, and that matter cannot exist without force. The best explanation of the origin of light that we can have is in the Scriptures. "God said let there be light and there was light." Light can be analyzed, separated into its various colors, and it can be demonstrated that it comes in wave lines and produces an image on the retina, but how it produces the effect we call light upon the brain is a mystery we cannot explain.

We often hear of one force being changed into another—heat into light, electricity into light; we never speak of one law being changed into another, although the various laws are propagated alike, nor do we speak of one note in music being changed into another, and yet they are all produced by motion. So with the natural forces; one kind of motion produces heat, another light, and still another electricity, and these produce different sensations on the brain. How these sensations are recognized we cannot tell, amd probably never will. They are what Spencer terms unknowables. We may trace light until it prints an image on the retina; then we are at the end of our course. We can follow sounds into the ear; there the brain takes cognizance of them, and how we become conscious of them we cannot tell. So with the action and reflex action of the nerves. We can by trials find that injury to one part may produce pain in another, and by repeating the trial find the effect constant and therefore set it down as law, but the reason why the effects are so transmitted we do not know.

DISCUSSIONS ON DENTAL CARIES.

Dr. Abbott: Four years ago Dr. Bödecker and myself took it upon ourselves to investigate the minute anatomy of the teeth in health and in disease, Dr. Bödecker taking the structure of the tooth as his division of the subject, while to myself was allotted the study of dental

caries. The results of our researches were published in the *Dental Cosmos.* [To assist in elucidating his remarks the speaker used a number of very greatly enlarged colored drawings.] As we all know, a tooth consists of dentine, enamel and cementum, and the pulp. You will observe a direct connection between the pulp and the tissues outside the tooth. The protoplasmic bodies are in direct connection with the living reticulum in the dentine and the cement, and also with the periosteum.

Fig. 1.

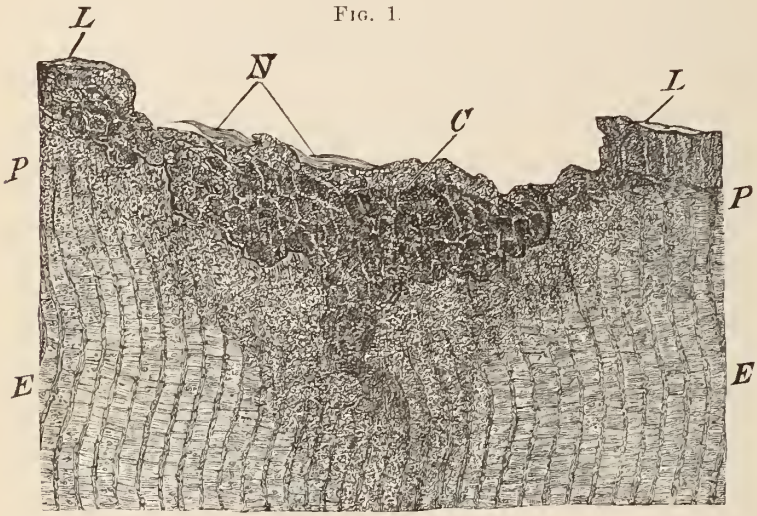


Figure 1 is an illustration of caries of enamel. All the living matter in every direction is connected, so that whenever one part is affected all of the tooth is more or less affected, because the life extends everywhere. I do not think this statement will be contradicted, that decay always begins with the dissolving out of the lime-salts of the enamel by the chemical action of some acid. Every tooth in a normal condition is free from decay, and it will not decay so long as it is kept in a state of perfect cleanliness. The enamel of the tooth is composed of 96½ parts of inorganic (principally lime-salts) and 3½ parts of organic matter. The illustration looks as though, while the continuity of the boundary was preserved, pieces of the surface had dropped in, having lost their supports. At the bottom the structure is nearly normal, only a little of the lime-salts being dissolved out; higher up it is more granular, and a step further and we come to the cavity of decay. We have

here a return of the enamel to medullary or indifferent tissue. As soon as the lime-salts begin to be dissolved out, an inflammatory reaction is set up which reduces the tissue to its original condition. As it progresses from the surface, we find the whole structure broken down, little by little, through the enamel to the dentine and possibly to the ultimate destruction of the tooth, unless its course is checked. Decay occurs either as chronic or acute. In chronic decay we have a different condition from that which characterizes the acute form. My observations show that decay assumes an acute or a chronic form, according to the perfect or imperfect calcification of the tooth. When the periphery of dentine is but little changed, and a narrow zone of yellowish color forms the boundary toward irregular shallow excavations, sometimes with various shaped elongations passing down into the dentine, it is called chronic caries, because of the slow course it runs. Low vegetable organisms are never seen in the substance of a decayed tooth. They may accompany it, but not as an exciting cause. If the pulp be dead there is no reparation. The acids go on to the destruction of the tooth, assisted only by putrefaction of its organic portion. Meat decaying gives as one of the products lactic acid, which is an active agent in the destruction of tooth-substance.

In acute caries we have deeper elongations into the substance of the dentine, mainly in the shape of fissures running independent of the direction of the dentinal canaliculi,—frequently across them. Sometimes these fissures seem completely isolated, but the probabilities are that they are connected in some way with the mass of decay. Sometimes the connection is by means of tracts of partially broken-down dentine. Viewed with a low power, say 250 diameters, the fissures seem to be filled with a granular mass, the remains of the former tissue. With a power of 1000 diameters we find that at a certain distance from the cavity the dentinal canaliculi look unchanged, and each contains the central transverse section of the dentinal fiber with its delicate offshoots. Approaching the cavity, the canaliculi become enlarged, and are filled with yellow protoplasm, in which is seen the net-like arrangement of the living matter. Still nearer the cavity the canaliculi are enlarged to many times their original size, sometimes several running together, forming a confluent cavity, and the basis-substance entirely disappears, and only indifferently formed protoplasmic bodies are visible. If a cavity in which acute caries has been at work is properly sealed up, recalcification will occur, but the dentine will be of a widely different

character from the original formation. The meaning of the enlarged canaliculi is, that the lime-salts have been melted down by inflammation. If the inflammation which produced it were taken away, recalcification would probably take place.

In caries of cement we have exhibited first all the phenomena known to be present in the early stages of inflammation of bone. Cement is almost identical with bone, having the same structure. If cement was subjected to the same conditions as enamel and dentine, its decay would be much more rapid, as evidence of which we all know how soon we have little holes all around the necks of teeth after recession of the gum, when food débris lodges and ferments there. Decay in cement is in its essential features analogous to caries of dentine when in a live condition; in other words, it is an inflammatory process. On the boundaries of the caries we see, besides unchanged cement-corpuscles, those which have been enlarged and transformed into medullary or inflammatory elements.

Down to 1831, I believe it was, all writers spoke of decay of the teeth as inflammation. Magitot, in 1868, stated that it was due altogether to a chemical process. Leber and Rottenstein claim that the leptothrix crawl into the canaliculi and enlarge them, so that the destructive agency can follow. I never saw such a thing as vegetable organism assisting the progress of decay. Even Tomes states that the process is simply a dissolving out of the lime-salts, treating the tooth the same as Magitot.

Dr. Chandler: Has Dr. Abbott followed Leber and Rottenstein's method of staining specimens?

Dr. Abbott: No, sir. The method used in preparing dentine and cement was slow decalcification, by means of a one per cent. solution of chromic acid; at least two months should be required to prepare the superficial layers of the tooth for cutting with a razor. To prepare enamel, the method first practiced by Dr. Bödecker was employed—splitting perfectly fresh teeth, by means of a saw, into thin lamellæ, grinding these down to the necessary thinness under water, and immersing the thin slices for partial decalcification in a one-half per cent. solution of chromic acid, for an hour or two.

Dr. Niles: Did I understand that the inflammation of the tooth-substance was caused by the pulp. If so, how do you account for decay in a dead tooth?

Dr. Abbott: No; it is an outside influence. Decay in a dead tooth is assisted undoubtedly by the decomposition of the organic matter of the tooth-structure.

Dr. Buckingham: Dr. Abbott uses the term inflammation of the dentine. What is inflammation? If we take the old phenomena of heat, color, swelling, and pain, and contend as some do that all of them must be present to constitute inflammation, then inflammation cannot take place in the dentine; but if we recognize it to be an excited state of nutrition running on until it ends in death of the part, then it may take place in dentine. May not a tissue die without being inflamed? and when dead it would decompose, or decomposition might go on to a certain extent without the tissue being inflamed or dead. The lime-salts are not essential to its vitality. We have frequently over the pulp a portion of dentine that is deprived of the calcareous matter, and yet it is alive. If it were dead it would not become recalcified, as it often does.

Dr. Bödecker: Dr. Buckingham, at the session last evening, wanted to know what is inflammation, and in his remarks stated the old doctrine of forty years ago, when the blood was supposed to be the principal if not the only agent in the inflammatory process. This theory has been considerably modified. Virchow said the blood-vessels had nothing to do with inflammation except to furnish material to be taken up by the cells, which he considered the primary seat of the inflammation and the only active agent in its production, inasmuch as they only could produce new cells; pus, in his view, was but the product of the cells. Cohnheim observed that in irritated tissues there exuded from the capillaries and small veins white blood-corpuscles, and he claimed that all inflammation was started by the emigration of the white blood-corpuscles. The fixed cells of the connective tissue do not, according to this investigator, share in the inflammatory process, but they are replaced by the emigrated white blood-corpuscles, which after having passed the walls of the blood-vessels represent pus-corpuscles, and by accumulation form a center of suppuration. Stricker, on the contrary, taught that not only the cells and blood-vessels are implicated in and necessary to the inflammatory process, which he claimed could not be produced in tissues separated from the vascular system, but that the cells swelled so as to kill or absorb the basis-substance; that all the offshoots of the cells may share in the inflammatory process through proliferation. According to this view, every inflammation should result in the formation of pus-corpuscles, which is not the case. All these views were based on only a partial knowledge of the ultimate structure of tissue. It was not until Carl Heitzmann published his discoveries in the microscopic anatomy of the connective

tissue that there was any proper comprehension of inflammation. According to him (and his views are now generally accepted as correct) the living matter is present not only in the formerly so-called cells and their coarser offshoots, but it pervades every portion of the connective tissue in the form of a delicate net-work; hence it follows that it will react upon the irritation, both in the protoplasmic bodies and in the basis-substance. The latter is merely liquefied, the reticulum of living matter becomes visible again, and thus the embryonal condition of the tissue is re-established; that is to say, inflammation is merely the return of a tissue to its embryonic stage. The embryonal elements (which were originally connected with each other by the delicate threads of the living matter) and their offspring represent what is termed the inflammatory infiltration. By a re-formation of a basis-substance there is a new amount of connective tissue, and the inflammation results in hyperplasia of this connective tissue. If, however, the inflammatory elements are torn apart, the inflamed tissue is transformed into pus. In the former case the inflammation is physiological, and results in a new formation of tissue; in the latter it is pathological, and there ensues a destruction, that is, a transformation into an abscess. Bone-tissue originates from the embryonal elements, which, in the majority of instances, are first formed into cartilage, then back to the embryonal state, and thence by the infiltration of lime-salts are transformed directly into bone. [Dr. Bödecker illustrated the process of tissue-formation by sketches on the blackboard.] The same steps take place in the inflammatory process. When the inflammation commences it dissolves out the lime-salts, and you have the original embryonal tissue. When it tends towards the formation of pus, the connections between the protoplasmic masses perish, and we have the isolated corpuscles floating in a serous fluid. Unless the course of the inflammatory process is changed, these perish, as there are no blood-vessels in the tooth, and decay follows.

Dr. Niles: I understand the theory of the inflammatory process so well described by the gentleman who preceded me, and which is laid down in our most recent works on pathology, and I agree with him so far as it is applied to soft tissue or hard tissue supplied liberally with blood-vessels, but I cannot make the deduction that the same process ever exists in the decalcified organic substance or matrix of a tooth, to aid or assist the tooth decay.

The lime-salts in the carious cavity of a tooth, every one must admit, are in an acid solution, which acid has the power to act upon

the tooth-substance to dissolve out the lime or mineral matter, and finally reduce the animal matrix to a soft, gelatinous mass, which Professors Abbott and Bödecker term embryonal protoplasm, or "a return to an embryonal condition." The only action that I know of about decalcified teeth that may be likened to an embryonal condition, is the absorption of deciduous roots; where there is no acid reaction, the whole tooth, mineral and organic, is completely absorbed. At the outset I will say, and Professor Abbott will agree with me, that if a tooth is kept free from acids there will be no decay. In regard to the question which I raised yesterday, or the fact that a dead tooth decayed faster than a live one, Dr. Abbott stated that inflammation assisted decay "very much," and that the exciting cause of it came from the pulp; according to that theory, a living tooth decays faster than a dead one. Suppose this to be the pulp of a tooth which is living and the caries sets in at this point. You believe that inflammation is in progress at this point, passing towards the pulp?

Dr. Abbott: The organic substance is returned to its medullary condition.

Dr. Niles: Suppose this is filled with decalcified organic substance; inflammation would be in progress at this point, would it?

Dr. Abbott: Passing toward the pulp.

Dr. Niles: Do you recognize that there is an effort on the part of the pulp to stop that progress?

Dr. Abbott: Not necessarily.

Dr. Niles: Have you made sections of tooth decay?

Dr. Abbott: Oh! yes, sir.

Dr. Niles: You will find an effort has been made by the pulp to fill up the tubuli indicated from this point. If you consider that action of an inflammatory character, I concede your views in that particular, but it tends to arrest, not to facilitate decay. It is a thickening of the dentine to arrest the inward progress of decay; and if this is effected, there is a circumscribed portion of that tooth about the cavity more dense and much harder than other portions of dentine. This, I believe results from the filling up of the tubuli. Is that your point of inflammation?

Dr. Abbott: That is the point.

Dr. Niles: You call the ossification or filling up of those tubuli an inflammatory process?

Dr. Abbott: No, no; Oh! no, thank you.

Dr. Niles: That has been my only idea, and the only explanation I can find of inflammation in tooth-structure. We find an illustration

when, after a cavity has been excavated and filled for a time with gutta-percha, on removing it an increased sensitiveness is found. The non-conducting properties of the filling cause a retention of heat at the point where the tubuli are being calcified. If an alkaline solution be turned into the cavity, or the acid neutralized, all of Dr. Abbott's embryonal or inflammatory processes will vanish. Magitot has demonstrated these points clearly, and I have, to a certain extent, reproduced his experiments.

Decay or dental caries may readily be produced out of the mouth by immersing a tooth in any acid capable of removing the earthy salts, leaving it there only a few days or weeks, according to the strength of the acid. The lime-salts will be gone, and only the organic portion of the tooth left,—that which we daily remove from cavities in the process of filling, calling it decay; if this is left in the acid for a still longer time it will become soft and gelatinous. This I understand Dr. Abbott calls an "embryonal element."

I should like to ask Professor Abbott how he prepared these specimens.

Dr. Abbott: The specimens are prepared by immersion in a weak solution of chromic acid, to which are added a few drops of hydrochloric acid every two or three days, and thus we dissolve out the lime-salts preparatory to cutting with a razor. The lime-salts are not held in solution, as in the case of inflammation of a tooth in the mouth, but are dissolved out, and they disappear from its substance altogether.

Dr. Niles: You made the sections of decayed teeth after decalcification?

Dr. Abbott: Yes, sir. We do not decalcify specimens of enamel, however, before preparing, but we grind and keep them moist from the time they are taken out of the mouth, until they are put under the glass.

Dr. Niles: This is certainly prepared in that way. Generally, Dr. Abbott will agree with me that acids are the exciting and primary cause.

Dr. Abbott: Primary cause.

Dr. Niles: They decay this portion of the tooth.

Dr. Abbott: I will not admit any such thing. Acid was the primary cause.

Dr. Niles: We will suppose that I add a little acid here, and that is the exciting cause. Now there is more or less acid in the cavity?

Dr. Abbott: When the cavity is formed there is more or less.

Dr. Niles: And it will give an acid reaction?

Dr. Abbott: Yes, sir.

Dr. Niles: Now, how am I going to preserve this carious specimen as it now is during the process of preparing for microscopic examination. Can I immerse it in another acid before making a section? Does not that acid have the same effect as the one at work in the cavity when the tooth was extracted, and does not decay progress as before and the condition of the cavity become changed? I think it does, Gentlemen.

The chromic and hydrochloric acids are good solvents for tooth-substance, and this is the way teeth are prepared when tubuli want to be examined; but sections through decayed cavities of teeth should be treated wholly by grinding; then you would see the tooth in the exact condition it came from the mouth, and not the results of the action of acids. Tomes and Magitot, I believe, first harden the animal portion of the tooth with alcohol, then grind this section on very fine corundum, finishing on Arkansas stone and polishing, keeping it moist through the whole process.

Mr. Tomes's present theory of the formation of the dentine from what at last become odontoblasts that cover the surface of the pulp will hardly admit of this theory of a return to an embryonal condition. I think, if I understand Dr. Abbott correctly, his theory of decay conflicts very materially with the present accepted theory of tooth-formation and development.

Dr. Abbott: Dr. Niles, intentionally or otherwise, misunderstands my position. We do not immerse enamel in acids, because we want the lime-salts for strength during the grinding process. We have dissolved the lime-salts entirely out after grinding, and have shown the net-work of living matter as perfectly under a power of 500 as you can see my hand. It must be understood that we are not preparing these specimens to look at lime-salts. Grinding either tears away or disfigures the organic matter, or renders it imperfect for purposes of observation. The object of putting into the chromic-acid (one-eighth of one per cent.) solution is to preserve the organic parts exactly. The solution must not be strong enough to disintegrate the enamel. The moment the living matter is exposed inflammatory action is set up, which is simply a return to the embryonic condition, and from which we may have the redeposition of lime-salts. In the old definition of inflammation, as given by Dr. Buckingham, swelling is noted as one of the characteristic symptoms. If this be true, how are you going to get inflammation in a

tooth, which cannot swell. The fact is that the inflamed tooth does the same as the inflamed soft tissues. It is reduced to its embryonic condition, from which it may be again differentiated into normal tissue, by the same process that originally formed it. The primary cause is a solution of the lime-salts by some solvent, some acid—something which has an affinity for the lime-salts. Unless this is checked it goes on until a portion of the tooth-structure is destroyed; the inflammatory process passes down towards the pulp, and the canaliculi are enlarged by the melting down of the organic matter, by which the lime-salts are thrown out and held in solution. There is no such thing as a filling up of the canaliculi, or vitrifaction. There is no attempt on the part of the pulp to stop the decay, except that when the inflammatory action is stopped recalcification begins.

Dr. CHANDLER: I understand Dr. Abbott to say this zone of resistance does not form until the outer cavity is stopped?

Dr. ABBOTT: Oh! no; I do not mean any such thing.

Dr. CHANDLER: That zone, as I understand it, is found in every cavity?

Dr. ABBOTT: Certainly it is.

Dr. CHANDLER: And you will find it in every cavity, be the cavity ever so small?

Dr. ABBOTT: Certainly.

Dr. CHANDLER: Leber and Rottenstein also take this ground. There is another point I noticed last night. In this section you refer to the appearance down here (pointing to the board), to the fact of this inflammation running through nearly sound dentine, and affecting the dentine below. This, of course, is partially decalcified. You speak of the effect going on below. How do you know the two carious spots have anything to do with each other? How do you know this does not belong to a part of the tooth you have cut through in making your section? How do you know it is part of the same trouble?

Dr. ABBOTT: I did not have any carious place out here.

Dr. CHANDLER: Are you sure of it?

Dr. ABBOTT: Yes, sir.

Dr. CHANDLER: I should be rather inclined to doubt that the caries there (pointing) has anything to do with this caries here (pointing). If that were simply a portion of the commencement of the zone of resistance, I might believe it, but that caries as such—this solution of lime-salts—has taken place from this inflammation above, I cannot believe. That, I believe, is another portion of the same, or another

carious cavity which is running underneath the dentine and enamel, and he has cut through that which has nothing to do, properly speaking, with the part of the section above.

Dr. Buckingham: Dr. Abbott, as I understand him, almost ignores any vital action in inflammation. Inflammation is pathological, and vitality is necessary for its production. Cut off a piece of cartilage, and it becomes dead and cannot go through the process of inflammation, though it will become decomposed. If dentine loses its vitality we cannot have inflammation, and yet the decay goes on. My idea is that all tissues are formed in a fluid; what this is composed of is not known. Albumen is a solution of lime-salts—97 per cent. water. With this we can imitate the production of bone, but the albumen becomes an almost indestructible substance. The fluid is so nearly neutral that a very little change will precipitate the lime-salts.

Dr. Mills: To my understanding, the definition and explanation is quite plain as given by Dr. Atkinson in his lecture upon that subject (with which you are familiar, doubtless), and in addition to this we have so intelligently given us the structural condition of the human tooth by the honest and arduous labors of Dr. Bödecker, which "all may read as they run." I am aware that this subject has been battledored and shuttlecocked from year to year under the voluminous divisions of heat, redness, and swelling. And what are they? Inflammation is simply a process of combustion supported by the same laws that any combustion is, viz.: upon the elements that are provided in nature's laboratory. In the inflammatory action we are dealing with, it is supported by those elements formed *alone* in the living matter. The degree of burning, as manifested in the unbuilding of the structure, which we call decay, is developed in its intensity in proportion to the quantity of *perfectness* and *imperfectness*. So we have a poorly organized or soft structure taken down with greater rapidity than the opposite, and also varying degrees of *disease* or pain. In the prolongation of the track of inflammatory action, so manifestly exhibited in the drawing of Dr. Abbott before us, we have an analogy in a partly burnt piece of wood; starting from the black carbon and running out into the faded shade, indicating a carbonized condition of a less degree, produced by a less degree of heat at that point. Just here I cannot resist the temptation to insert the declaration that all building and unbuilding of the human tooth (or other tissues) is but a process of carbonization, differing but in degree; by this I mean calcification and recalcification is carbonization produced by this combustion or burning constantly going on in the

organization, supported by the play of excited elements upon the unexcited, arresting the direction of nature at her appointed time and place.

Dr. Crouse: I did not expect to occupy any of the time of this Association on this subject, but the theory of Dr. Abbott and the views advanced by him are so at variance with my belief that I want to see who is so far in error.

If I understand him correctly he denies that nature does anything to prevent the decay of the teeth until the cavity is filled; that nature does nothing after decay commences to hinder or retard its progress. Is that your theory?

Dr. Abbott: In the great majority of cases.

Dr. Mills: How would you answer the question as to what we call arrested decay, where there is no stopping at all?

Dr. Crouse: That is a good question. I have seen—and every practitioner must have observed the same thing—instances where decay had destroyed a portion more or less of the tooth, and then the disintegration stopped, the surface became as hard as flint, the cavity was never filled, and there had been no treatment of the inflammation. The position of the tooth changed or the tooth adjoining was removed, or in some way the cavity was kept clean, so that acids could not form from the decomposition of vegetable matter, and food could not lodge. The saliva was allowed to flow there and wash away the acids, and nature arrested the decay. I have just such a case in my own mouth, where one-third of one of my lower bicuspids has been lost by decay. The tooth adjoining, which was also decayed broke away, thus destroying the receptacle for the lodgment of food and formation of acids, and nature stopped the decay. The tooth has been in this condition for fifteen years. I have seen the same thing where teeth have been separated, also where the patient took better care than formerly to keep the teeth clean, and nature did her part by throwing out ossific matter and arresting the decay. It is a part of nature's economy when an injury occurs in any part of the system to make an effort to arrest or repair it. And I had the idea that inflammation was one of the first processes to that end. According to Dr. Abbott, inflammation is the destructive agent in dental caries. If I understood him correctly he said, acid first destroys the enamel, and when the tubuli are reached inflammation sets in, and through this inflammatory process the tooth is destroyed, or at least he said the dissolution of the lime-salts was much more rapid on account of it. In any other portion

of the system, if the bones are injured, inflammation is the first restorative process. If a bone is broken, inflammation is the first thing that occurs, and I do not suppose we could have any uniting of the fractured parts without it. According to Dr. Abbott's theory, in case of a fractured bone we would be reduced to a mass of pulp in a very short time.

I think the same laws govern the entire system, and inflammation is not the cause or a part of the cause of dissolution of the lime-salts in our teeth, but is one of the means to restore or prevent destruction. If inflammation hastens or causes decay, why do teeth when the pulps are devitalized decay faster than those that have living pulps? Other things being equal, pulpless teeth decay faster than those with pulps, at least I have always supposed so; for the reason that in the case of pulpless teeth nature does nothing to arrest the ravages of decay, and in the other case the pulp throws out ossific matter and retards it.

Dr. Abbott: The gentleman evidently misunderstands my position. What I wish to be understood as saying is this, that it makes very little difference whether a tooth be filled, or kept free from acids or decomposing food in any other way, the result will be the same, a recalcification of that portion of the tooth which has been partially decalcified.

Dr. Crouse: You acknowledge that acid destroys the teeth?

Dr. Abbott: I acknowledge that acid is the primary cause of all caries of teeth, and that it is an important factor in its progress. It must be taken into consideration, however, that in a tooth there is something besides lime-salts to destroy and remove in the process of caries. In enamel there are three and a half parts in a hundred of organic matter, in dentine twenty-eight parts, and in cement about thirty-three parts. Now, can it be possible that this organic matter is dissolved away the same as the lime-salts? I should hardly suppose such to be the case, but a process of decomposition must take place in order that it may be removed and a cavity formed in the tooth. In order that this decomposition may take place, all the stages, from that of irritation up to that of death, must have occurred before decomposition could begin. In a dead tooth, as soon as the organic substance composing the matrix which holds the lime-salts becomes exposed, putrefaction *at once* begins. In the process of putrefaction of the organic portion, undoubtedly lactic acid is formed, which materially aids in dissolving the inorganic portion.

Dr. Crouse: Will a tooth without a pulp decay as fast or faster than a live one?

Dr. ABBOTT: Usually a little faster.

Dr. ATKINSON: Inflammation is a great stumbling-block when we talk about it or consider it in the old way. It is a burning, and there are two kinds of burning; eremacausis and burning in open fire. The first makes coke and charcoal in a smothered fire, and the other kind of burning frees water and carbonic acid, which pass away, leaving the mass of carbon as coal. When we understand this, that the oxygen combines with the hydrogen and goes off in flame or smoke and leaves the carbon exactly in the relation in which you see it in the coke or charcoal, combustion will be plain. If we desire to burn these entirely up and get an ash, we must have the supporter of combustion in abundance, which is oxygen, and then they are changed into carbonic acid gas and ashes. These are the products of complete combustion every time. The rapidity and slowness with which these changes occur, present us with the nourishment of the body and the destruction of the body, known as constructive and destructive assimilation. This process goes up and down the scale of molecular activity, which consists in a simple change of position of the molecules by reason of the calling for the energy resident in the atoms, which, when awakened and engaged, constructs the molecules and the tissues which are the elements of the organism. It is by reason of this change in the ultimate elements, and the relations they hold to each other, and the measure of engagement of these bonds that we get the basis of nutrient activities. If they are fully engaged, as long as they are guarded, it is a good match, and the family will go on very well. As to "decalcification and calcification," that is a mass of absurd nonsense. If we would say "liquefaction" and "resolidification" we would come nearer the mark of comprehending the changes involved. So far as the line of "resistance" is concerned, such as is displayed in the pulp-chamber opposite (that is, at the ends of the tubules whose periphery is included in the decayed spot) the cavity or abrasion, we shall have to relegate the explanation to the physiologist and pathologist, who alone can comprehend either the process or the instigator of the process by which the changes are effected. When all the changes involved in the building, nourishment, and repair or destruction of the tissues shall have been completely revealed, we may be entitled to do something much better than blubbering about mere mass-presentments of the *effects* of functional disturbances, such as talking and writing about "cones of resistance," just as if these mass-observations led the masses of our profession to the

comprehension of nutrient, de-nutrient or therapeutic modes, measures, or means.

Dr. Waters: I wish particularly to address myself to those persons who do not see that both chemical and vital action are taking place here at the same time. The first effect of acid upon a tooth, it is easy to see, is a chemical one, a solution of lime-salts from the surface, thus impairing the integrity of the tooth before nature is aware of an attack, and, of course, before she is prepared to defend or restore the injured part. After awhile the invasion reaches a point where salts of lime in solution—a plastic or fluid condition—begin to satisfy the demands of the acid to a small extent, and then destruction of tooth-substance is, to that small extent, arrested. If the acid action continues, the demand for repair will after a while be felt on the inside of the tooth, and then through minute channels will come a flowing forward of plastic material to satisfy that demand. The first movement will be at the point of attack, and from that point inward until a current is set up, which, from its inception, begins to lessen the thickness of the walls of the channel by its own friction, and continued, renders the tooth more vascular, and eventually forms the "cone of repair." Here we have vital action cutting away the tooth to satisfy the chemical demands of acid. If now a portion of the tooth is cut off, so as to expose the surface of the tooth where the acid has been generated to the friction of food sliding over it, then nature stops the forward movement of the column of defense, and by repair closes up these channels; the surface ceases to be sensitive, and becomes harder and solider than before. More work can be done, as more nutriment can be carried forward; more lime-salts to neutralize the acids, which are destroying the outside. If a portion of the tooth is cut off so that the food slides over the surface and cleanses it, nature seals up these channels again, and the whole surface becomes harder and more solid than before, and I think you will all agree with that proposition. I think that is the simple fact of the case.

Dr. Brophy: This matter in regard to the formation of secondary dentine is one in which I have been for some time deeply interested. I desire to speak of the pathological changes which I believe take place, and the efforts of nature to arrest them. The presence of an acid (most frequently lactic acid) in the fissures and surfaces of the teeth in contact with each other causes the enamel to disintegrate, and this disintegration, chemical change, or destruction of the integrity of the teeth, we term caries.

When caries has penetrated the enamel, inflammation of the organic matter within the tubuli of the dentine, owing to the contact of acids and other irritants, almost invariably follows, and it is then that a demand is made upon the system by the nerves that supply the parts, as if by telegraphic communication, for material with which to form a barrier to resist the invasion. Immediately the blood transports material and the tubuli begin to fill up, gradually converting the dentine into a solid mass. The advance of caries and the filling in of the tubuli occur simultaneously. Although the solidity of the dentine does not absolutely arrest decay, its advance is doubtless rendered less rapid.

The tubuli between the carious tissue and the pulp-chamber are finally completely filled with calcium salts in consequence of constant and prolonged irritation from without. When these tubuli are partially or completely filled, we have the cone or zone of resistance spoken of by Magitot.

The calcium salts continue to accumulate after the tubuli are filled, organize, invade the cavity of the pulp, and in some instances almost wholly fill it.

This formation is distinguished from the cone or zone of resistance by the name of secondary dentine. I believe dentine that has been softened or partially deprived of calcium salts by the action of acids, is not infrequently repaired by a new deposit of these salts.

The cone or zone of resistance and secondary dentine are produced by nature in its effort to protect the delicate and sensitive tissue of the pulp, and to prevent its exposure by the advance of decay. Caries usually, however, eventually finishes the work of destruction it has commenced, unless prevented by skillful treatment.

We all know that a large cavity in a tooth recently filled with metal is generally quite sensitive when subjected to thermal changes. In the course of time, however, not exceeding a few months, this sensitive feeling subsides, since the cone or zone of resistance has formed. and, sensation, therefore, is no longer as easily transmitted from the metal filling through the dentine to the pulp within.

Dr. Abbott: Why does not nature stop it (decay) before it commences? Or prevent it from commencing at all?

Dr. Brophy: Simply because the enamel is disorganized by the constant presence of acids. As soon as caries penetrates to the dentine, we have vital force brought into action to resist its progress.

Dr. Friedrichs: Why is not the whole tooth reproduced? One is as possible as the other.

Dr. Brophy: I have not said, nor do I believe any portion of a tooth that has been destroyed and removed by caries is reproduced; but I do say that soft, partially decalcified dentine over which fillings have been placed *is* refilled with the salts of calcium, and restored to a density as much greater than the original normal dentine as the filling of the tubuli can make it. This hardness of the dentine, doubtless, has been observed by all after the removal of fillings. There is a character of caries which has not, I believe, been mentioned in this meeting. The cementum of the teeth, richly supplied with organic matter, is exposed by the recession of the gums. Here we have caries brought about by the action of an alkaline agent which removes the animal matter of the cementum and dentine beneath; after which the walls of calcium remaining rapidly disintegrate.

Dr. Moore: I wanted to ask the eminent physiologist who has just spoken the cause of trouble in the teeth of certain classes of our people, which is of great importance. He spoke of decalcification or liquefaction of the dentine. What is the cause of the decalcification or liquefaction in the teeth of our Irish emigrants after they have been in this country a few years? We see the same thing among the negro population. Where the negro is confined to the plantation, and while he prepares his own diet in a simple manner, his teeth, in the majority of cases, are perfect. He has no need of the assistance of the dentist; but take him from the field, bring him to the house, subject him to the refining influence of civilization, and his teeth begin to show it in a remarkably short space of time. I should like to hear from these gentlemen the cause of this liquefaction in these particular cases.

Dr. Peirce: The inquiry raised by our friend, Dr. Moore, I deem of more than ordinary importance; it is one also of great interest, because it is based upon personal observation, and gives us a tangible clue to one of the causes resulting in the almost universal disintegration of tooth-tissue. A change of diet, a change in the manner of living, brings with it, not infrequently, a marked change in the durability of the teeth. Dr. Moore here gives us an example fully illustrating this in the negro transferred from the out-door work on a plantation where his plain fare, prepared by himself in his humble cabin, gives him food capable, from its coarse, dense, and dry nature, not only of keeping the teeth clean by its trituration, but also of stimulating the more highly organized soft structures to a degree of health and functional activity far exceeding that resulting

from the ordinary diet of the household domestic, where soft food and warm drinks furnish the larger part of the pabulum taken through the day. It is the old story, "absence of function, loss of capacity." This same thing is true with our domestic animals; deprive them for a length of time of food for which their masticating organs are adapted, and they lose the power of properly preparing that food for digestion and assimilation. Go with that indefatigable worker, Henry Bergh, to the stables of the slop-fed cows of this city, and you will sicken at the shocking, loathsome sight there presented. Cows, whose milk is sold for the nourishment of thousands of children in this city, are toothless, gumless; the oral cavity, instead of evidences of health, giving forth filth and offense from absence of function, loss of capacity, and deficiency of nutrition. The preparation of soft food, the habit of washing it into the stomach without trituration, together with the concomitant evils that follow, is certainly, in the human family, one of the most prolific sources of dental caries.

I think Dr. Abbott must certainly have misrepresented himself when he stated that molecular disintegration of the hard tissues of the tooth may go on to the "liquefaction of the lime-salts," an actual breaking up of the continuity of the organic and inorganic part of the tooth; and yet by filling up the cavity with these broken-down mineral organic portions within, that the continuity is re-established, density and health-normality regained. I cannot believe it. Broken-down lime-salts, as well as the disintegrated organic matter, may remain in the cavity and serve as some protection to the living tissue beneath, but that their continuity and vitality are re-established without going through the digestive and assimilative process is certainly very questionable.

Dr. Abbott stated in his remarks yesterday "that he had never found bacteria in the cavity of decay." The presence or absence of bacteria depends, it is supposed, upon a putrefying fermentation; fermentation may go on to the formation of a destructive acid without necessarily resulting in putrefaction, but if, under the influence of heat, moisture, and confinement, putrefaction does occur, then most surely bacteria will be found present.

The popular theory respecting the influence of leptothrix upon tooth-structure is doubtless incorrect, and is the result, it seems to me, of a limited knowledge concerning its germination, pabulum, habitat, etc. True, it is found in cavities of decay, but not in greater profusion nor more prolific in those where decay is rapidly progressing, than where disintegration has been entirely arrested, on the

tartar, or between the teeth, or on the tongue, where it grows most vigorously from the desquamated epithelial cells; indeed, wherever there is disintegrating organic matter of either vegetable or animal origin, it is found in profusion, provided moisture, heat, and atmosphere are favorable. Its influence is certainly benign; in its consumption of dead matter its tendency is to render acid secretions alkaline. In fermentation we have another vegetable growth, the *cryptococcus cerevisiæ*, a little cell or capsule. In its development and multiplication sugar is consumed and an acid is the result. To this little cell we are indebted for our vegetable acids, which are the result of fermentation, and also for the acids of the oral cavity, which are so destructive to the dental tissues.

Dr. Taft: The statement has been repeatedly made in this discussion, that after decalcification resulting from decay of the tooth, the residue assumes, or is in an embryonic condition; just what is meant by that expression is not clear to me.

Is it that this residue possesses the form and condition of the developing body or organ? And, if so, at what period of the embryonic development? For it must be remembered that this process is a progressive one; each period exhibiting aspects and conditions peculiar to itself. Now, which of these aspects and conditions is promoted by the residuum of dental decay?

The propriety of this nomination is certainly not warranted without further evidence than the bare statement of any one individual. Is it claimed that this residue has within it all the elementary substances that go to make up the embryo? I think no one will, without qualification, make such an assertion. Or is it affirmed that the structural character of this residue is like that of the embryo? If so, in what respect? The residuum in tooth-decay varies exceedingly in different cases in the retention of its structure. In some it is wholly destroyed; in others it is retained in a remarkable degree of completeness, and there is every degree of presentation between these extremes. It is true that in decay of the teeth the order of the disintegration is, in one aspect, the reverse of its upbuilding; in the latter process the introduction and fixing of the calcareous constituents is the conclusion of the work; while in the former the removal of the inorganic part occurs early, if not at the beginning of the process.

Reference has been made to what seems, on the diagrams presented here, to be a cavity wholly surrounded by solid dentine—not having connection with the surface nor any other cavity of decay. The

impression made, on some at least, was that this was an evidence of internal decay, or might be. Now, it must be remembered that this presentation in the diagram is only that shown by a thin section—what relation it sustains to the structure at either side of it is not shown. I am not aware that the existence of internal decay of the teeth has anywhere been proved, or that it has been made to appear even probable.

The impression first made is somewhat modified by the admission of Prof. Abbott that this seemingly inclosed cavity might have had connection with some other cavity. This apparent opening, which must have been very small in the tooth, may have been the result of arrested or defective development at that point. Such defects often exist; they are found in both the enamel and the dentine.

The discussion, thus far, would lead us to the conclusion that decay is produced by free acid that may have been in the mouth for some time before its attack upon the teeth. This view I regard as incorrect. The agents that produce the disintegration of dentine in decay are usually found at the time and at the point of attack, and work with the energy of the nascent state. This, if correct, has a practical bearing in this respect: that much reliance cannot be placed upon the topical use of antacids for the arrest or retarding of decay.

Indeed, the mouth, as a whole, may exhibit an alkaline condition and still decay be going on rapidly, and this can only be accounted for upon the theory that the disintegrating agent is formed at the time and point of its action upon the tooth-substance.

Dr. Abbott: I would state, in correcting the apparent misapprehension of Dr. Taft, that if he understood me to say that any such appearance as this indicates here, could be found in the body of the tooth without any connection with the decayed surface at all, he made a great mistake. I never dreamed of such a thing, never said it, but said as positively as I could, not only yesterday, but to-day, it is simply a liquefaction, which Dr. Atkinson has stated is a better term to use, and re-solidification. That liquefaction takes place from inflammation that occurs, and is not due to any acid at all.

Dr. Crouse: He has just made the remark that it was acid and inflammation. Before he said it was inflammation that produced the acid condition. Is it acid in there that does it, or inflammation?

Dr. Abbott: How queer some people will be. I say decay begins upon the surface of the tooth by the action of an acid; that the

lime-salts, as far as they are carried off, are dissolved by acid which is produced probably at this point; that the moment living matter becomes exposed we have an irritation set up, which penetrates the living matter of the tooth some distance, and is sufficient to liquefy the glue-giving basis-substance.

Dr. Crouse: You said the inflammation did not do it.

Dr. Taft: Dr Crouse's question is a pertinent one. I hold that inflammation, *per se*, cannot liquefy a calcareous salt. Then, if the inflammation does not do it, what does it? If it is acid, whence does it come? It is a pertinent question, and the gentleman ought to have answered it, and answered it squarely; as he told us yesterday he would discuss this subject, and if anybody had any questions he would answer them—a bold proposition, but perhaps the doctor is equal to the emergency.

Dr. Atkinson: Gentlemen are bound to listen. I assert that he did not say that the acid dissolved the portion external, but if it penetrated the living matter, by the irritation the inflammation was set up.

DISCUSSIONS ON ABRASION.

Dr. Chandler: I had the pleasure of listening to Dr. Davenport's paper last night. As far as it went it seemed to me very excellent, but he seems to be on the wrong track when he calls the work of mineral acids spontaneous abrasion. He referred to Dr. Harris's account of this trouble, but gave a different reason for it by referring it entirely to the breathing-in of acids, and not, as Dr. Harris says, to an acid mucus, produced by the mucous follicles at the end of the tongue. I do not take much stock in Dr. Harris's explanation, and I think Dr. Davenport has not hit Harris's idea. I have among my patients two gentlemen who have the same affection spoken of by Dr. Davenport. They are in the manufacture of acids; the largest manufacturers in New England. They are brothers. When young men, their father put them into the acid factory to learn the business, so that they might know every step of it. Their teeth were affected very much in the manner Dr. Davenport describes, but it is not Harris's abrasion. The form his abrasion takes is a double curve on the ends of the front teeth of both jaws. They would be otherwise normally shaped. In these cases, however, the acid has not chipped off the ends, but has taken away from the labial surfaces, most at the ends, and diminishing as we approach the gum in a curve.

This will be the shape of the tooth after it has been eaten by acids. That process goes on in the same way until, by and by, there is no tooth left. Harris's figure is a different thing. Harris's takes this form: Here is a furrow down in the center of the front teeth; every center ridged in this way. The upper teeth are the worst. (This was illustrated by drawing on the blackboard.) Harris speaks of the cause of his abrasion, but I will not venture to say if he is right or not. I have also two patients who have that form of abrasion. One is a clergyman who never saw the inside of an acid manufactory; who has nothing to do with acids, except sharp things he has to say with his tongue. Another is a bank cashier, who is not in the habit of eating pickles; who is not in the habit of sucking acid fruits nor drinking lemonade. They eschew acids of all sorts. The trouble has gone on in both increasingly for the last five years. It is chiefly in the four front teeth. The canines do not seem to be affected; but wherever you find this trouble on the front teeth, you will find a similar trouble on the molars and bicuspids. The molars are often hollowed out. They are eaten out as though by acid. The center of the cusps is hollowed like a cup. Wherever you find this abrasion of Harris's, you will find this condition of things in the molars and also the bicuspids, but not so marked. I have noticed it a good many times, but these two cases are the worst I have ever seen. I cannot account for it. It is evidently the work of some acid. Where the acid comes from I cannot say, but the destruction is on the ends of the teeth entirely, and not on the front, as in the cases Dr. D. speaks of. The gums are not affected. The line of the arch above the enamel does not seem to be troubled, but the mischief is on the ends of the front teeth, and on the ends of the molars. There seem to be several kinds of affections which are counted abrasions. This kind is probably spontaneous abrasion, if there is any such thing, and is due to a solution by acid, and that acid of oral formation and not from without.

Dr. Atkinson: When we talk of spontaneous abrasion, I should like to have anyone define what the spontaneity is. I hold that all the functions of the body are spontaneous action of the part that operates the activities of organized beings; and, if we talk in that general sense, I have no objection, but to say spontaneity will operate in a certain locality of itself, and at this one location, I am in doubt as to holding any views about it whatever. The cases referred to here and in Harris are not very uncommon. I have seen a number of them in my life, but I have seen something that is even

more ambiguous than this. I have seen S-shaped excavations cut in clear across the entire surfaces of the tooth on the buccal, and around the proximal on to the lingual wall, and this wall entirely sound, and these excavated surfaces as polished as in the best examples in nature. I have seen it in a number of cases on bicuspids, molars, and cuspids, but never on incisors. I have seen the form Prof. Chandler speaks of a number of times, but as to knowing anything about the cause I do not pretend to. But the surface is so handsomely polished that I have desired some means by which I could finish disintegrated enamel as well as these are done, and get as fine an appearance. Where this has interfered with speech and mastication, I have resorted to filling up these furrows temporarily, and so got encouraged to put gold in, and build out to contour. In the great majority of instances this has been successful. In a few instances disintegration has gone on at the margin of the gold, and required a secondary operation. I never had it recur after the second effort to arrest the trouble. As to the antecedents which lead to this possibility in tooth-structure to take a special kind of limit to decay, I have speculated a great deal. I have seen this, probably, more frequently at the margin of the gums than at any other place, and at such places as a tooth-brush could not reach, and on the lingual border of the gum on bicuspids and molars and canines. In the other form there is simply chemical solution, and we have abundant proof of this in the attendants upon acid factories, as has been referred to. Do we know that acid does it at all? I should rather say a disintegrant, and use some other term that suggests a breaking down of the structure itself, than to confine myself to saying it must necessarily be an acid. I should prefer the term solvent or disintegrant, for I feel we are very far from scientific accuracy, when we so blindly assert that it is always an acid that produces it. What are my reasons? That in a great many instances there was no possibility of detecting acid.

Dr. Barrett: I have no special theory to offer, but desire simply to say, that at the present time I have two patients as unlike as they well could be, and the teeth of both are affected in this way. One is a young, the other an old lady. One is healthy, hardy, robust; the other pale, weak, anæmic. One has light hair and a nervous temperament; the other is dark and bilious. The secretions of the mouth of one are distinctly and strongly acid; of the other almost as distinctly alkaline. Ordinarily I have cut out all such places and filled them. In one of these instances I did so, but as the other

lady is a well-known vocalist, I have hesitated about the matter, because of the conspicuousness of such fillings. I have applied every remedy that suggested itself to my mind in vain. Filling has usually been a cure for this abrasion, and my opinion is, that to this the case over which I have long hesitated must eventually come; but I shall put off the evil day as long as possible.

Dr. Litch: Whatever may be the truth with regard to other forms of destructive metamorphosis in tooth-tissue, that form known as erosion seems unquestionably to require a vital condition of tooth-structure for its development. I have never seen a fully characteristic case of erosion in a devitalized tooth. The smooth and polished appearance of an eroded surface is not characteristic of a simple acid reaction on lime-salts; a non-vital surface eroded by acids is always roughened. Acid secretions may be an exciting cause of erosion, but, in my judgment, the vital force of the living matter in tooth-substance is an essential factor in the production of the lesion in question. Erosion may, perhaps, well be denominated an atrophy induced by some as yet undetermined cause or causes.

Dr. Cushing: Dr. Litch's remarks lead me to relate an instance of a very marked corroboration of his statement, that dead teeth rarely, perhaps never, present that condition. In the mouth of a patient of mine, every tooth, from the second bicuspid on one side to the second bicuspid on the other, is affected in that way, except a central incisor which is devitalized. That is not affected at all. All the others are to a very great extent; the cuspid tooth on the right side to fully one-third of its diameter; the other cuspid not so much. That is a very strong corroborative instance, as both living teeth and a dead tooth are present in the same mouth.

Dr. Fundenberg: A patient who has been under my father's care for many years, and who had his teeth placed in perfect order some two years ago, presented himself at our office about one year afterwards, complaining of a great sensitiveness near the necks of the teeth. Upon careful examination it was discovered that this "breaking down" of tooth-structure had occurred upon the labial, palatal, mesial, and buccal surfaces of every tooth in the upper jaw, with the exception, I believe, of the two central incisors. There was very little destruction of tooth-structure that was not beneath the gum. It had extended so far that several of the teeth were almost lost by it, and this all appears to have taken place within the space of one year's time. I do not know how to account for it. The cavities were prepared, being quite sensitive, and were filled

with plastic fillings; since which time I have not seen the patient.

Dr. Brockway: What was the condition of his health?

Dr. Fundenberg: Good health; strong, robust; about sixty years of age; Scotch descent, and had never dealt in acids.

Dr. Barrett: Any urinary difficulty?

Dr. Fundenberg: No urinary difficulty that I am aware of.

Dr. Brockway: The cases just mentioned very nearly correspond with one which came into my hands about nine years ago. A young man presented himself for examination, having apparently perfect teeth. At the first glance I was inclined to say that they required no operation, but upon closer observation, I was surprised to find this condition of "grooving" around the necks of the teeth which has been referred to, partly concealed by the gum, and in most cases more than half encircling the tooth. All the teeth of the upper jaw except the molars, and all of the lower except the molars and second bicuspids were thus affected. The trouble was evidently of recent development.

I questioned the gentleman as to his health, which he assured me had always been good, but presently correcting himself, said that he thought he had felt some trouble with his kidneys of late.

I sent him to a physician in whom I had confidence, who upon examination confirmed his suspicions and successfully treated him for his ailment. When this had been done, I filled with gold all the affected teeth. I saw him occasionally afterwards for some two years or more, and during this time there had been no recurrence of the trouble. Since then I have lost sight of him.

Dr. Waters: A year ago last October, a sea-captain came to my office to have his mouth attended to. He had that condition of the teeth described by the gentleman from Pittsburg, where decay had taken place beneath the gums. The crowns of the teeth (many of them) appeared very healthy. Some were badly decayed, some entirely gone, and in this case the decay had taken place beneath the gum, and the crowns broken off. During the time I was operating, he had some trouble with an inflamed pulp or two, for which I had to use a good deal of treatment, but in these teeth there was not this trouble of decay under the gums that I have mentioned. He said he never had been confined to his bed in his life, but that he had several times been troubled with his kidneys, and was so at that time. He could not remain in the chair an hour at a time, consequently it was difficult for me to operate with gold, and I concluded that, under the circumstances, perhaps it would be just as well

to use plastic filling; and I selected oxyphosphate. The man I also learned had a trouble with his liver; but whether this trouble of the kidney and liver had anything to do with this condition of the teeth, I do not know. He was an inveterate tobacco chewer and smoker.

DISCUSSIONS ON ANESTHESIA.

Dr. Barrett: Last year I read a paper before this Association upon anesthetics and anesthesia. I then declared my purpose to continue this line of experiments, and made a half pledge to present at this time another paper having for its special subject nitrous oxide gas. I never worked harder than in the attempted fulfillment of this partial promise. In my note-books are complete records of about one hundred and fifty experiments and vivisections in the line of this research. It was but very recently that I finished them, and when I was through, what with these studies, my professional duties, and some other labors which had burthened me, I found myself utterly fagged out. It seemed that my brain was exhausted; my pond was dry, and the more I pumped and pumped at it the more roily and unsatisfactory was the product. When I had finished a paper of respectable length I found upon looking it over that it was quite unworthy to be presented here. I was ashamed of it and resolved to throw it away, confess my inability to properly collate the results of my labors, and ask your indulgence. I have the data still in my note-books, and perhaps at some time may be able to dig something out of them. But at this meeting I am forced to appear before you under the shadow of an unredeemed pledge, and will endeavor to make such present atonement as a few extemporaneous remarks may carry.

Notwithstanding the early introduction of nitrous oxide gas, its extended use and careless mode of administration, it is an undeniable fact that deaths from its exhibition are much less frequent than from any other anesthetic. Do we fully comprehend the extent of this immunity? I have not the statistics at hand to verify my statement, but I believe that despite the almost exclusive use of other agents in all the great hospitals nitrous oxide is the most widely employed of all the drugs which produce narcosis. It is also administered to the widest range of persons so far as physical condition is concerned. There are many people suffering certain forms of diseases to whom the most reckless of practitioners would not give chloroform or ether, but to whom nitrous oxide is freely

administered. To many dentists there is absolutely no physical condition which positively forbids their administering this gas. Then, too, it is used by perhaps the most ignorant and stupid class of persons that can be found among our people, for if there be any set of men more recklessly obtuse and more dangerously unenlightened than is the average cross-roads dentist, I do not know where they are to be found. Yet these men are extensive employers of nitrous oxide. Chloroform and ether are in the hands of better educated men. They are mainly employed by men of medical training, and the people at large have too wholesome a dread of their danger, and are too well informed concerning their properties, to intrust their use upon themselves or their friends to a dentist who has just as much knowledge of materia medica and therapeutics as the manufacture of rubber dentures teaches. But all these men are making and administering nitrous oxide, impartially to friend and foe, young and old, strong and weak. It is in fact the especial refuge of the quack. You and I know, Mr. President, that when we look upon the brand-new, gilt-edged sign of a dentist who flauntingly offers to extract teeth without pain or danger, that he keeps one of those dental butcher shops where nitrous oxide is widely employed. When we see some boastful advertisement in the newspapers promising that Dr. Blank extracts teeth in a positively delightful manner and without the slightest risk, we recognize the trail of the same old serpent. It is nitrous oxide, and every experienced practitioner knows both these men for the worst of charlatans. Sometimes Dr. Quack endeavors to cover up the matter by claiming a new discovery and calling it "Vitalized Air," but we know that it is still nitrous oxide, and that the advertiser is one step lower than the average pretender, for he is not alone an ignorant, but a dishonest and vicious quack as well. Despite their ignorance and recklessness these fellows manage to get along with comparatively few accidents. Chloroform and ether are administered by thoroughly qualified, well-educated physicians, and yet their death roll is a very respectable one. Nitrous oxide is used by the opposite class, and there seems a comparative immunity in its administration. How shall this be accounted for, Gentlemen? We cannot shut our eyes to the fact; we cannot ignore it; it will not down at our bidding. Is it not rather important that we examine into the physiology of it and learn whence comes this apparent harmlessness? Ought we not to examine whether it be real, and, if so, whether the present harmlessness be offset by future complications and perils?

There are a number of theories by which to account for the narcosis produced by anesthetic agents. One is that it is due to a want of oxygen in the tissues. It seems to me quite sufficient answer to this to show that the insensibility produced by asphyxia is quite distinct from anesthesia. The symptoms, the progress, and the phenomena of the two conditions are quite unlike, and the post-mortem appearances show a wide divergence, so that there is no necessity for any further expenditure of time in this direction. Again, it has been held by some that anesthesia is due to hyperoxygenation. That this cannot be true in the exhibition of chloroform and ether is amply proved by the fact that the supply of oxygen is very much lessened, while the amount of carbonic acid eliminated is decreased. Nitrous oxide presents the same phenomena and the theory therefore does not hold good with that agent. Another hypothesis is that narcosis is due to interference with neural nutrition, but an examination of the tissues, the rate of its progression, as well as its incompatibility with well-known physiological laws, forbids our acceptance of this theory. It is also argued that narcosis is due to certain specific qualities which inhere in the agents; that anesthetics have the potentiality to dominate nervous impulses, that it is their special office to so paralyze nervous tissue as to make it impossible for it to perform its functions, and that this obtunding of all nervous sensibility up to a given point, this locking of the tissues of the voluntary system in oblivion, we call anesthesia. To me this seems the only reasonable way of accounting for the phenomena; and the special symptoms accompanying each separate agent are due to some properties perhaps aside from those which induce unconsciousness. But all anesthetics have this in common: they paralyze nervous tissues according to a definite rule, the progress of the insensibility always being from the periphery towards the nerve-centers. That the effect of some agents is more quickly produced than that of others, and that in some it is evanescent and weak, while in others it is profound and lasting, is due to peculiar qualities of the agent aside from its anesthetic properties. But there are certain phenomena in the progress of the narcosis which are common to all anesthetics, but which are quite distinct from those produced by agents which simply bring about asphyxia; as, for instance, a regular graduated rate of progression in the tissues; certain peculiarly marked stages of nervous disturbance, and the character of the spasms which sometimes accompany their employment. It seems to me that these are so distinctly marked that

there need be no necessity for the confounding of the one with the other. I am supposed now to be particularly considering the anesthetic qualities of nitrous oxide gas. All my experiments and observations lead me to the inevitable conclusion that it does not essentially differ from ether or chloroform, the other best known anesthetics, in its actions and effects, and that it truly belongs to the same class. I am aware that in saying this I antagonize well-known authorities who do not consider it an anesthetic at all, but I am sure that full consideration of all its qualities will convince most people that its peculiar effects, while partaking of the same character as those of the other agents, are produced in the same manner. Its apparent harmlessness is due to its weak toxicological power.

In the administration of all anesthetics it is necessary that sufficient of the agent be in existence in the blood at one time to produce characteristic effects. The blood is the agent in distributing it to the tissues, and while a certain amount of even the most powerful agents may exist in that fluid with entire impunity, if the proportion be increased beyond a certain limit the characteristic effects are soon manifest. An atmosphere containing one or two per cent. of chloroform is insufficient to induce narcosis; but five per cent. will slowly produce insensibility, while twelve per cent. causes the patient to quickly succumb, too often with alarming symptoms. The potentiality of ether is not quite so great, but does not widely differ. That is, a person may inhale an atmosphere containing a definite amount of ether, chloroform, nitrous oxide, bromide of ethyl, carbonic acid, carbonic oxide, or chlorine gas without being materially affected by them, but if this proportion be exceeded, and thus sufficient of either agent be introduced through the pulmonary surfaces into the blood and be thus existent there at one time, its characteristic effect is produced upon the tissues. This proportion widely differs with the agents used, but there is a certain line which cannot be overstepped with impunity if we wish to avoid pathological changes. Some of these agents produce but a feeble impression, from which the patient soon recovers. Others exert so profound an influence that when once their power is fully manifested recovery is doubtful and slow. Thus there is a wide distance between carbonic acid and carbonic oxide (CO_2 and CO). So there is a great gap between nitrous oxide and chlorine gas. Of the one large proportions mixed with common air can be breathed without any perceptible effect; of the other a comparatively small admixture is fatal. Now,

my theory and belief regarding nitrous oxide is that it is potentially weak, and therefore we find it necessary to as quickly as possible overwhelm the whole system by introducing into the blood as much as possible in a given time. In administering it, therefore, we cut off the entire supply of air, and let the patient breathe the gas exclusively; at the same time we urge him to rapid and deep inhalations that we may introduce the greater quantity of it into the blood before elimination commences. We reach the point of insensibility as soon as possible, because we know that in a definite time the breathing of the gas must be suspended that asphyxia may be avoided. All who have had experience with this agent are aware that unless the patient quickly passes under its influence alarming symptoms supervene. The lips and features become blue and purple; the pupil of the eye expands, and clonic spasms threaten. In fact, the patient is becoming asphyxiated for want of the oxygen which has been entirely cut off. A person will breathe nitrous oxide exclusively just as long and no longer than he can carbonic acid gas. The contrary has been asserted, but, Mr. President and Gentlemen, I have experimented too long and too exhaustively in this direction to be easily mistaken. In an atmosphere of pure nitrous oxide gas and one of pure carbonic acid I have a great many times demonstrated that animals live the same time and die about simultaneously, the only marked difference being that, in the first, anesthesia is primarily induced, and during the subsequent symptoms of asphyxia the animal is unconscious.

I had proposed to demonstrate these points by vivisection, to be performed before this body; experiments entirely painless of themselves to the animals used, and had the meeting been called anywhere but in New York I would have tried to be prepared; but here you have one man, Mr. Bergh, who, actuated by some unaccountable impulse, has planted his attenuated form directly in the path of progress, and has attempted to stay the exploration of physiological subjects. I judge no man's intentions and impugn no man's motives, but it does seem to me that nothing but the densest ignorance of the methods of carrying on physiological investigation could induce any one to make the assertion which Mr. Bergh has made. Whether it be from a kind of morbid vanity which impels him to the most absurd actions that his name may be aired in the newspapers, or whether it be from a mistaken or from a natural sympathy with the lower orders of animals, certain it is that through special legislation which he has procured and through the wresting of the law from its natural

interpretation, no sooner does a man attempt to save his fellow-man from misery and danger by the interposition of the life of some worthless cur-dog which it is an act of mercy to destroy, than Mr. Bergh through his paid agents interferes and plainly demonstrates with whom his sympathies reside, and with which order of beings he desires to be classed. I am, therefore, debarred from demonstrating these statements before you this year, and you must accept my statement that I have many times before dental and medical societies, in the presence of learned professors and skilled physiologists, in all the various methods practicable, and after the most careful study to eliminate every source of possible error, again and again and again proved that nitrous oxide will asphyxiate as certainly and as quickly, when all sources of oxygen supply have been cut off, as will carbonic acid. I have tried to make an exhaustive study of the comparative effects of these two gases that I might clearly to myself differentiate their symptoms. I have two large glass jars covered with ground glass cones with two holes in each for the introduction of the fresh and the escape of the used gas. They are of the same size and shape. One of them has been filled with carbonic acid gas and the other with nitrous oxide. After each was thoroughly tested I have introduced two rabbits of the same litter or two pigeons of the same brood, or two rats of the same size, or two cats, or two dogs as nearly alike as could be procured, one into each jar. The tubes from the carbonic acid generator and from the nitrous oxide tank were then introduced into their respective jars, and a steady stream of fresh gas conducted to the bottom that no claim could be made that a contaminated gas was employed. The gases used have been of my own manufacture or that of some friend, and in addition I have procured and used repeatedly the liquid nitrous oxide and liquid carbonic acid furnished by Johnston Brothers, of this city. And now for results. There never has been any material difference in the time of death of the animals; sometimes one, sometimes the other gas seemed by a few seconds to be most quickly fatal. In the nitrous oxide, narcosis supervened usually in from one to two and one-half minutes, with a contraction of the iris. No narcosis existed at that time in the animal confined in the carbonic acid, but the iris was gradually expanded. From this time on the symptoms are usually about identical, the iris of the anesthetized animal commencing to dilate, and finally both die with nearly the same attendant symptoms. Post-mortem appearances were, however, widely variant. The blood and tissues of the animal which

had breathed carbonic acid gas were dark in color and the heart was engorged. The tissues of the other animal were generally light in color, the heart was completely clear, but the brain was engorged—the ventricles sometimes containing extravasated blood. The light color of the blood for a time led me astray, and I believed or at least suspected it to be due to oxygenation; subsequent experiments, however, convinced me that I was in error in this suspicion. Nitrous oxide is exceedingly soluble in the blood, and it unites with it, causing the change in color. But it unites as NO and not as dissociated elements. Carbonic oxide also unites with the blood and changes its color somewhat. Nitrogen dioxide unites yet more freely than the monoxide. That nitrous oxide can for a moment sustain respiration I think I have exhaustively disproved, but air when very largely diluted with it will sustain life for a long time. In nitrous oxide the two elements have united and formed an entirely new substance, and before it could by any possibility exercise an influence in sustaining respiration its decomposition must take place. One might as well say that nitrogen dioxide would sustain life as to affirm it of the monoxide unless it can be proved that it is more readily decomposed. Now, if a lighted match be introduced into a jar of nitrous oxide the combustion becomes almost as brilliant as in oxygen. But in this case the heat is sufficient for the breaking up of the compound and the setting free of the oxygen. All the nitrogen compounds are unstable, and this is no exception, but it requires a definite force to dissociate the atoms, and abundant experiment proves that the heat of the body is insufficient for this purpose.

I wish I could demonstrate these things before you, but it is now beyond my power. You can, however, try experiments for yourselves. But if you are about to commence such a course let me warn you of a few things. You will sometimes get most contradictory results, and it will require long patience on your part to deduce a constant law. There are so many sources of error, especially to the beginner in experimental sciences, that it requires long experience to at once detect them. Remember that one swallow does not make a summer, nor one experiment overthrow long established laws. I well remember when after my apparatus was completed I invited a learned professor of chemistry in a well-known medical college to witness my first demonstration. Pigeons were introduced into each jar. In the nitrous oxide, to my surprise, the pigeon was dead in less than three minutes, while in the carbonic acid the other lived sixteen minutes. I afterwards found out that

the probable cause was due to pathological conditions of my animals, but the professor was very much astonished, and declared that his whole science was at fault, as he had confidently predicted a contrary result. In experimenting with birds their peculiar anatomy must not be lost sight of. They have supplementary abdominal air reservoirs, and before you are certain that these may not affect the result it may he necessary to anesthetize them, insert a tube in the trachea, inflate the lungs and these reservoirs, that they may readily be found, and then, raising the point of the sternum, enter the abdomen and rupture these membranous sacs. The birds may then be left to breathe through the abdomen, and this source of error will be avoided. Let no student set out with a favorite theory which he desires to prove, or anything which he wishes to disprove. Let him seek for truth and be prepared to recognize her in whatever garb or unwelcome form she may present herself. Every student should also make careful post-mortem examinations of animals destroyed that he may see the effects of his experiments upon particular tissues.

Dr. Buckingham: I wish to ask whether Dr. Barrett has observed that nitrous oxide gas has any specific action upon one organ as distinct from the rest.

Dr. Barrett: I am inclined to think that when an animal or a man dies from the direct influence of the gas, it is from blood-tension in the brain. I have seen but few such cases and usually there were present all the symptoms of apoplexy, and in some animals dead under such circumstances I have found extravasated blood in the ventricles of the brain. In the profound state of full and quiet anesthesia the brain is usually anæmic, but during the excitement-stages of narcosis it is hyperæmic, and this in all anesthetics is the dangerous period. If this excitement-stage in nitrous oxide should pass away and the brain become relieved of its pressure, I should not expect danger, but should for some reason the blood-tension be increased the gravest consequences might ensue.

Dr. Meigs: I understand that Dr. Sims kept a lady under the influence of nitrous oxide for one hour and fifty-nine minutes, and I believe that Mr. Johnston told me that he had known several cases in which the influence was continued for from forty-five to forty-eight minutes.

Dr. Barrett: I have kept a patient in a surgical operation under its influence for thirty-seven minutes. It was done by carefully watching the case, and as soon as symptoms of asphyxia were manifest, air

was admitted until they passed off and recovery was imminent, when the gas was again applied. But there were times when consciousness was nearly complete, and only for a very perfect control over the patient, she could not have been kept upon the table.

Dr. Meigs: I should like to ask another question, regarding the capacity of different persons for taking gas. And, while I am on my feet, I will say that I saw a patient who required so much gas that it was necessary to keep the valve wide open, and I marveled greatly at the quantity which she consumed, which must have been from thirty to forty gallons, although no bad results followed.

Dr. Barrett: Many persons have almost entire immunity from the effects of particular drugs. Some people will get drunk upon a teaspoonful of whisky, while others will drink a pint. It is owing to some peculiar physiological condition or to some extraneous influence, and aside from that which inheres in the drug itself. It is a peculiar idiosyncrasy.

Dr. Litch: I am very hopeful that the investigations of Dr. Barrett may throw light on this obscure and interesting subject. In his remarks he takes what I judge to be the right view of the physiology of nitrous oxide gas, namely: that anesthesia from this agent is a specific effect upon the nervous system, and that it is not due, as has been suggested, either to hyperoxygenation or to carbonic acid gas poisoning. It is, perhaps, not a very clear definition of the effect of nitrous oxide gas to say it is specific, but it at least eliminates an erroneous hypothesis. There is no question at all that nitrous oxide, N_2O, is as distinct a chemical compound as water, H_2O. One can be almost as readily decomposed as the other; nitrous oxide by the action of heat, water by the action either of heat or of the voltaic battery. The amount of heat necessary, as stated by Dr. Barrett, to decompose nitrous oxide, far exceeds the normal temperature of the body. It requires a red heat. This gas will not ignite an organic substance until it is at a temperature of perhaps one or two thousand.

Hence the fallacy of the idea, first advanced, I believe, by Dr. Colton, that anesthesia from nitrous oxide is really a condition of hyperoxygenation, the N_2O being decomposed in the lungs or blood and free oxygen thus obtained. The temperature which would decompose nitrous oxide would destroy all animal organisms. Moreover, it has been found that after N_2O has been breathed into the lungs, and has produced its full anesthetic effect, it is eliminated from the lungs unchanged still N_2O. In the interesting experi-

ments made some years ago by Dr. Evans, of Paris, this fact was fully demonstrated. He passed into the lungs a measured volume of the gas, and passed into a receiver all the products of expiration, from the beginning of the administration of the nitrous oxide to its end. He found the nitrous oxide to come from the lungs unchanged in its chemical structure, and that about three quarts remained in solution in the blood at the time of complete anesthesia.

That anesthesia from nitrous oxide is not carbonic acid gas poisoning is proved by the facts that the nitrous oxide does not contain the carbon element, and that the characteristic effects of the two compounds are quite dissimilar in many important particulars. That the patient may be asphyxiated by nitrous oxide is unquestionable, just as he may be asphyxiated by ether or chloroform or opium, through arrest of the respiratory functions; but in each case he is asphyxiated because he is narcotized; he is not narcotized because he is asphyxiated. In each case the effect is a specific one with well-marked characteristics, differing with the agents employed.

Dr. Barrett attributes to a weak potentiality the safety which attaches to the use of nitrous oxide. In this, although I am not disposed to be dogmatic upon the point, I think that he is a little in error. Neither ether nor chloroform, even when their pure vapor is inhaled, produces complete anesthesia in so short a time as nitrous oxide. With nitrous oxide complete anesthesia comes on with what corresponds to the second of the three stages of etherization, namely: the stage of tetanic muscular contraction, this being followed in ether and chloroform narcosis by the stage of complete general muscular relaxation, a condition which cannot be safely attained with nitrous oxide, although we often, indeed generally, have this condition of muscular relaxation produced in the muscles of the tongue and fauces, as evidenced by the stertorous respiration which usually marks the stage of complete anesthesia in nitrous oxide narcosis. An average of over six minutes of time is required to produce complete anesthesia with chloroform, and an average of over eight minutes with ether. That agent can hardly be said to be weak in potentiality which produces, as does nitrous oxide gas, complete anesthesia in less than one minute.

It is true that when its exhibition is discontinued, consciousness and sensation are restored as rapidly as they have been lost; but this is due not to its weak potentiality in, but to its rapid elimination from, the system. If duration of the anesthetic effect be taken as the index of potentiality, then alcohol is the most potent of all

anesthetics, for alcohol narcosis with its profound anesthesia will often last for hours. This, indeed, is the anesthetic preferred and recommended by Dr. John Lynk for all surgical operations, he giving to an adult about a pint, in tablespoonful doses, twenty minutes apart. The patient simply becomes "dead drunk" and completely anesthetized, in which condition he will remain for a much longer period than with any other agent usually employed. This matter of duration of effect seems to be in a measure dependent upon the physical structure and method of administration of the agent employed. Thus, alcohol is a liquid, absorbed into the circulation from the digestive tract; it must there remain until eliminated by the excretory organs, or consumed by a process of oxidation in the system. Ether, closely allied as it is chemically to alcohol, the one being C_2H_5HO, *ethyl hydrate*, the other $(C_2H_5)_2O$, *ethyl oxide*, will, when administered by the stomach, produce almost precisely the same line of physiological effects; but owing probably to its superior volatility the duration of those effects will not be so great, its influence as an intoxicant rarely lasting for more than an hour. But when ether *vapor* is administered by the lungs, the physiological effects, while almost the same as before, are much more transient; a result clearly due to the form and manner in which the drug is administered. The vapor easily escapes from the blood and lungs. Nitrous oxide, being a highly volatile gas, escapes more readily and rapidly than ether; while the effects of the heavier vapor of chloroform are more prolonged. To this rapidity of elimination, characteristic of nitrous oxide, is doubtless due, in a measure, the comparative immunity from fatal results which has thus far attended its administration; although this is, of course, more due to its chemical constitution, as is the case also with ether vapor; the chlorine element in chloroform rendering it the most dangerous of all. Darin's statistics show a ratio of one death in 2872 administrations of chloroform; one death in 23,203 administrations of ether; and one death in 100,000 administrations of nitrous oxide. Prof. Roberts Bartholow sums up thus far an aggregate of 500 deaths from chloroform narcosis.

In regard to the safety of nitrous oxide, however, this qualification must be made, that there are very many persons who attribute permanent impairment of their health to its agency. They say, "I took nitrous oxide gas; such and such symptoms resulted, and I have never been well since." These statements must, of course, be taken with a grain of allowance, because people are notional. *Post*

hoc, propter hoc is not always a logical assumption. But I have heard of so large a number of such cases that I think the subject worthy of investigation. The late Prof. Geo. T. Barker held very decided views upon this subject with reference to his own case. He claimed, if I remember correctly, that congestion of the lungs and pneumonia followed the inhalation of the gas, and that from the effects he never fully recovered.

Dr. Barrett: Perhaps there was nothing sufficiently definite in my remarks of last evening to demand any extended debate, and yet there are some points which, for my own satisfaction, I desire to make more clear, if possible, even if the keen intelligence of others does not demand any further elucidation. I stated that my own conclusions were that the apparent immunity from danger in the use of nitrous oxide gas was due to its lack of potentiality. I believe that to be the case. Professor Litch, if I understand him aright, attributes it to its ready elimination from the blood. I question his premises, because the disengagement depends not so much upon the volatility of the gas as upon its solubility. As nitrous oxide is much more soluble in the blood than the other vapors referred to, it would not be so readily eliminated, because of the closer bonds which hold it. A gas not readily soluble would be separated with facility, while that quickly taken up would be tardily restored again.

I stated last evening that nitrous oxide is a true anesthetic, but to produce its full effects it is necessary that it be breathed exclusively, and that all air be excluded; that the system be quickly overwhelmed with the great quantity of the gas rendered necessary by its weak potentiality. The primary influence of all anesthetics is not upon the nerve-centers, but at the peripheral extremities, and the progressing wave of domination is along the course of the nerve-filaments inwards. True anesthetics also affect primarily the sensory nerves, as might be predicated from the manner of the progression of influence. The office of sensory nerves is to convey impressions from without to the centers, and the progression of their paralysis is in the same direction. Woorari affects the motor nerves, and it commences at the nerve-centers, and the progression of its influence is *towards* the periphery. See how beautifully the proposition proves itself, as thus: The office of the motor nerves is to convey impressions from within outward, in direct opposition to that of the sensory nerves. The influence of woorari is from within towards the extremities; *therefore*, it affects but the motor nerves; or

woorari affects but the motor nerves; *therefore*, its progress is from within outwards. Of anesthetics the direct converse of this is true.

A few words now concerning the nomenclature and symbol of nitrous oxide. Nitrogen is a bivalent, and its atoms always reunite in pairs; oxygen is univalent, its atoms joining singly; consequently there can be no such compound as the symbol NO would express, because for every atom of oxygen there must be two of nitrogen, and the simplest compound which oxygen and nitrogen can form must be N_2O, and that is nitrous oxide. The two gases unite in different proportions to form a chemical series, which is something like this:

N_2O, Nitrous Oxide.
N_2O_2, Nitric Oxide.
N_2O_3, Nitrous Acid.
N_2O_4, Hyponitrous Acid.
N_2O_5, Nitric Acid.

This is according to the modern nomenclature. Formerly, I believe, nitrous oxide was written NO, to express the protoxide of nitrogen.

Dr. Litch: I would like to state that by modern chemistry, oxygen is bivalent and hydrogen univalent.

Dr. Atkinson: I do not accept either the old or the new nomenclature of molecular change as at all satisfactory. I hold that every atom is septivalent in its potentiality; that we have not yet surveyed the entire field so as to comprehend more than a very little of molecular change. That which is understood as a molecule is produced by at least two atoms of different kind, in combination, and the only exception known to me is oxygen, and it has been called bivalent. When combined with a diverse atom that is manifest. But when two atoms of oxygen constitute a molecule this is a different sort, or a sleeping molecule of oxygen.

Oxygen in this condition is ready to combine with any atoms having affinity for it; but to make myself demonstrably plain, I would require considerable time, and have to make drawings on the black-board. It is requisite to show the position and order of the atoms in the molecule to comprehend the awakening of the units of energy, in any measure, which the type of the molecule demands to be engaged to form its specific body, from one to seven measures. When we find these we will learn which is the skeleton or nucleus of the molecule and which is the skin or periphery of its body. Until that is understood, we cannot comprehend anything of the

change. When we talk of "physical difference" and "potential sameness," under such circumstances, we are holding our ignorance and darkness out to the gaze of lookers-on. For there can be no *physical body* without the command of the *potential energy* arranged in *typical proportions*, which must be satisfied to construct a molecule that is alive; and when it is completely satisfied, it is then what has been called dead. It is then a crystal or it is remanded to the state of atomicity; and these are the bonds we must take into account if we desire to have bodily conformation and function revealed. If we were going to write this formula according to my beloved Litch's opinion, we would have to write it in this way, N–O–N. Then the people would say at once that here (pointing to the formula) is a bond of energy belonging to this (pointing again), one of the sleeping bonds, and the other has awakened these, and it is a single one. That is called a univalent, and it is bivalent. That does not prove there are five more sleeping bonds of energy in that very atom of oxygen, and that is a single atom of oxygen, but that one is not a single atom. That is a molecule of oxygen of two atoms, and is given to us as representative of that fact. If it be written that way, you must put it that way.

Dr. Buckingham: Matter exists in the form of atoms, but it is always found in the form of molecules. The atom is the unit of the chemist, the molecule the unit of the physicist. A molecule is the smallest particle of a compound or it may be atoms of the same element. The affinity of atoms is so great that when they are liberated from a compound they immediately unite in some form. If there is no other kind present they combine with one of their own and form a molecule. This accounts for the fact that at the moment they are liberated their affinity is very strong, but when they are combined in the molecule their affinity is partly or wholly satisfied, and hence they are less disposed to form other combinations. Some atoms will combine in one proportion, some in another. Hydrogen combines with chlorine only as one to one, with oxygen as two to one, with nitrogen as one to three, and with carbon as one to four. Water is always formed by the combination of two atoms of hydrogen with one of oxygen, and never varies. Two elements may combine in several different proportions and their compounds are entirely different. Nitrogen and oxygen combine in five different proportions. The lowest, nitrous oxide, is the gas we use as an anesthetic. The highest combination is nitric anhydride, which with water forms one of the strongest acids. N_2O, forms a molecule

of nitrous oxide, or we may write it N-ON. It is a definite compound. If we take one atom of nitrogen from it, or add one atom of oxygen to it, we form another compound with entirely different properties. Nitrous oxide, N_2O, is a colorless gas. Water at the temperature of 60° absorbs more than its own volume of the gas. Under a pressure of 50 atmospheres it becomes liquid, and may be frozen at 150° below zero. Its specific gravity is 1.527, showing that the two volumes of nitrogen and the one of oxygen are condensed into two of nitrous oxide. It will support combustion nearly as well as pure oxygen, and can be breathed for a considerable time without any serious effect.

Nitric oxide, N_2O_2, or as it is commonly written NO, is a poisonous gas. Water dissolves only one-twentieth of its volume. It is absorbed by a solution of sulphate of iron (green vitriol). It is a very poor supporter of combustion, very few substances burning in it. It absorbs oxygen and combines with it to form the peroxide, N_2O_4 or NO_2, which may be recognized by its red color. This gas is said to appear sometimes in making nitrous oxide.

Although the nitric oxide contains twice as much oxygen as the nitrous oxide, it is a poisonous gas and would soon destroy life if it were breathed.

How does nitrous oxide act when inhaled? Some think it is decomposed and gives its oxygen to the blood; but if this were so oxygen itself would be the best anesthetic, which we know it is not. Nor does it act chemically. We have three anesthetics in use: nitrous oxide, N_2O; ether, $(C_2H_5)_2O$; chloroform, $CHCl_3$, all different chemical compounds. The first is a good supporter of combustion. the second will not support combustion, but will burn, while the third burns with a very dull yellow flame. We could hardly select three chemical compounds that would be more unlike, and yet, when inhaled, have the same effect. They must act as a compound by their presence in some way not understood. If they were decomposed their elements would be comparatively inert. If we cannot determine the way in which they act, we might possibly find out what special organ or tissue they affect. Is it the whole nervous system or some special nerves, or do they act on the blood and through it on the cells, and suspend their function and stop the whole process of vitality? These are questions that can only be answered by noticing the effects of the agent during the administration.

SECTION VI.

Pathology, Therapeutics, and Materia Medica.

There was no Report from Section VI.

SECTION I.

Artificial Dentistry.

Paper by JOHN ALLEN, of the Section.

As the dental profession embraces different branches, and as the subject assigned us upon this occasion includes that of artificial dentistry, we propose to call your attention to the very close relation this department bears to the fine arts, for in this branch of dental science we have in many instances to reproduce, not only the organs of mastication, but also the natural form and expression of the human face. And the time has come when this should be regarded as one of the most important points to be attained in this branch of our profession.

The skillful artist is enabled to observe and study nature, and from that standpoint to see forms, sizes, shades, etc., in their minute varieties, and to catch the different expressions which are so evanescent that they would escape his attention if he did not know their source. The dentist finds that it is this reducing of things to their proper principles which elevates this branch of our profession, and gives it more the character of an art than of a mechanical trade. As, therefore, a thorough knowledge of the fundamental principles of art and science are important acquisitions alike for the artist and the dentist, we will endeavor to define some of the essential requisites in artificial dentistry in its various relations to the arts. For example, the artist finds it very necessary to become familiar with the anatomical structure of the human system, so that in his copyings from it, he may be able to transmit to the canvas the proper form, proportion, position, and expression which existed in nature's model, and thus portray faithfully the different features of the face in his picture. So with the dentist; he too requires these same qualifications in the discharge of his professional duties, and also to adopt a fixed rule to imitate nature in all cases where the natural organs or features are to be

restored, adhering to this maxim as a governing principle in the construction of artificial dentures. In executing his design, he should study the form, proportion, and expression which previously existed in the physiognomy of his patient, so that, by the aid of art, he will be enabled to restore that harmony in the features of the face which will prove true to nature; for a work of this kind cannot please unless this result is attained. In proportion as this principle is observed, this branch of our profession becomes more of an art, and is appreciated accordingly.

It is said that the value and rank of every art is in proportion to the mental labor employed in it, for then we find spirit, conception, force, and effect, and also exquisite finish. But to acquire the requisite knowledge to embody all these qualities requires the artist to be a close and careful student and copyist of nature. Whether he displays his skill upon canvas as a portrait painter, upon marble as a sculptor, or upon the human face as a dentist, he should possess a high order of artistic skill in all its details, such as the true artist displays with his brush in representing the fine texture of the skin, the indication of a vein or muscle, the waving line of beauty or of expression; for all these he goes to nature and studies her more and more in the smaller as in the greater things. So, too, the sculptor, executing his designs, labors long and earnestly to bring out a true reproduction of the proper form and position of every muscle of the face, so that each one will be in perfect harmony with the entire physiognomy of the living model which he endeavors to represent. See the watchful care of the photographer in his fine touchings over the picture formed by nature's art on his chemically prepared paper, lest in putting on the flesh-coloring he mar or deface the expression.

Now, if all this care and skill in minute detail are requisite in the arts, how much more important is it that we should observe them in our efforts to restore the natural form and expression of the face when marred by the loss of the dental organs, which are to be replaced with artificial substitutes! These should be so constructed and adapted to the physiognomy of the patient as to restore that harmonious reflection from the countenance which previously characterized the person for whom they are intended. And to do this requires artistic skill and taste far above that tame and lifeless style which renounces truth of expression and character of the features of the face.

Now, in order to avoid degeneracy of taste and poverty of conception in this branch of our profession, let it be based upon purely

scientific and artistic principles. It is upon these that we must rely in order to bring out a pleasing expression; for it is expression which dwells pleasantly or painfully in the memory. If this is disfigured or distorted by illy-formed dentures, the defacement of the countenance becomes repulsive to the beholder, and a source of humiliation to the wearer, as the result shows at once that the artist was not there to preside over the operation. But if a perfectly natural result is obtained, and harmony of the features restored, then it is evident that the requisite skill was employed in accomplishing the work.

It is said that every artist paints his own character; so with the dentist. It is by his works ye shall know him, and as he daily chronicles his own record by his works, so stands his professional character.

In conclusion, allow me to say that in the construction of artificial dentures the following important requirements should be kept in view:

First—Have the plates or foundations perfectly adapted to the mouth of the patient.

Second—Let every tooth represent its proper class and character in reference to length, form, size, shade, position, and expression.

Third—Let the gums, roof, and rugæ of the mouth be truthfully represented.

Fourth—If any or all of the muscles of the face have become sunken, they should be raised or restored to their natural contour.

Fifth—Have the lingual surfaces of the dentures of such form as to produce no impediment in the speech of the wearer; and have all these requirements so perfectly blended together as to present symmetry of form and natural expression.

SECTION I.—Continued.

Dental Prosthesis—Its Relation to Articulate Speech.

PAPER BY GEO. F. GRANT, OF THE SECTION.

PROSTHETIC dentistry does not receive the careful consideration in all its details that it deserves from the profession at large; and it may be said that what is called the decline in this branch of our art is not due so much to the introduction of cheaper

materials *per se*, as to the fact that the art, as it has been practiced, has found its proper level in the hands and materials of the men at whose door is laid the charge of its prostration.

There is nothing to prove that the work in this department which has been done in years past owed its superior reputation more to artistic skill scientifically applied, than to mere triumph of skill over refractory materials; and, viewed from this stand-point, the introduction of the new materials was an element of advancement if it had been properly regarded, for it certainly left wider scope for the application of esthetic and scientific principles, which was impossible or of great difficulty in the earliest days of the profession.

Now, while the standard of skill by which we are judged in the mind of the public has been much advanced in the department of operative dentistry, this other and not less important branch has languished and ceased growing. The most of us are waking to a realization of the fact that a change must come, and the many excellent papers which have lately been written upon the subject of the selection, arrangement, and adaptation of artificial dentures bear witness to the thoughtful attention that is being brought to bear upon the subject, and give great reason to hope that dental prosthesis will soon occupy a higher plane in the estimation of the public, as a result of higher achievement on the part of the dentist; and to assist in the furtherance of this object, your attention is invited to a consideration of the subject of this paper.

The loss of the organs which we are called upon to replace is of a serious nature, and produces effects which are of very grave importance to the whole economy. This fact is so plainly apparent to all of us, and so much has already been said and written upon the subject, that no further consideration of it in any general sense need be entered upon in this connection, but we will consider it in the special relation of its influence upon speech.

The voice is quite an important factor in the establishment of individual identity, and sometimes remains as the last feature of that identity; the one that enables us to recognize the individual at once, long after the features have become eliminated from our memory, or changed beyond our power of recognition. While this peculiarity of tone-quality, or *timbre*, as it is called, is not equally marked in all individuals, it is an undoubted fact that it is one of the first in importance of the various characteristics which mark the differences by which we determine identity. And of all the changes effected

by causes which are immediate in their result, a change in the voice is perhaps the one which reminds us most forcibly of its existence; for we may shut our eyes to other defects, but our ears are ever open to a change of voice, and particularly so to one which involves an objectionable quality of tone or faulty articulation.

The changes which most directly follow the loss of the teeth and absorption of the alveoli take the most immediate effect upon the speech, though their influence upon the voice is sometimes very remarkable and in most instances quite noticeable. Voice may be briefly described as the motion imparted to the atmosphere by the passage of a column of air over the vocal bands while in a state of tension. Articulate speech is the result of certain interruptions produced in the passage of this sound-wave through the natural channels to the outer air.

The first element in the voice governing speech is pitch. The second, which is closely allied to it and marks its idiocrasy, is quality or "timbre." When the vocal bands, under a greater or less degree of tension, are set in motion, the result is voice, and the impact and consequent reflection from the point of its incidence produces the first modification, which is pitch. The formation of articulate speech begins and is carried to its perfection from this point, for it is the result of impressions made upon this reflected sound-wave by the tongue, lips, palate, teeth, pharynx, and resonating cavities formed by the buccal walls. An approximate idea of the important part which the teeth have in the production of speech may be gained from a brief consideration of the changed relations of the other factors which are entailed by their loss. The absorption of the alveolus follows the removal of the teeth. The result of this combined misfortune is the removal of the support furnished the buccal walls and the lips, their consequent contraction diminishing the size of the oral cavity, and obliterating whatever of resonating space existed between them and the lost parts.

The tongue is deprived of much of its power by the loss of support which it had received from the teeth in articulation, and loses the aptness and precision of location which is a characteristic of it in a normal condition of the oral cavity. In fact, the loss of a single tooth from either jaw, if it be taken from a position between the median line and second bicuspid, will have an instantaneous effect upon the articulation, caused by lack of proper support to the tongue. Another very important consideration is the loss of reflecting surface involved in the removal of the teeth. From their

peculiar shape they derive much of their power in the production of tone by virtue of the great amount of surface which this form presents as a modifier of sound.

I think it would be within reasonable limits to say that the teeth present fully one-fourth of the whole amount of vibrating surface involved in the function of articulation. There are other and important changes effected in the production of speech by the loss of the teeth, but I hope to be able to treat of them more fully in considering how much may be done by way of prosthetic treatment, and of the best methods to employ in securing desirable results.

In the preparation of an artificial denture intended to replace the lost organs, we are confronted by several obstacles which seem to be insurmountable, so far as the restoration of the original conditions to the production of correct and distinct articulation is concerned. If but few teeth are missing and the loss is distributed through the arch, the difficulties attending their replacement are not so great; though a few of those little details which go so far in producing great results may very properly be noticed. In cases of this description there has been no appreciable loss of tissue which has a more direct bearing upon the articulation, than is effected by the loss of support to the tongue, or obstruction to the too free escape of sound incidental to the loss of one or two teeth. We have, however, to consider the adaptability of different materials to the purpose of retaining the teeth, and also the presentation of the minimum of obstruction to the free action of the tongue.

In the construction of a plate designed to retain a few teeth in position, a metallic base is the best, for the obvious reason that it combines the maximum of strength with the minimum of bulk. Of the metals gold is the best, from its ready adaptability and limited liability to oxidation. If the plate is supported by clasps, the greatest of care is needed to secure that relation between the plate and clasps which will insure a firm retention of the piece in close contact with the portion of the palate covered by it.

It has been customary to regard a clasp-plate as having advantages over a plate retained by atmospheric pressure, because the first could be made much smaller and thus interfere less with the free movements of the tongue in articulation. I think that this distinction has been made too sweeping and arose from a lack of consideration of the proper methods in adapting the two forms of plates.

The sounds most affected by the presence of any foreign body covering the anterior portion of the palate, as is the case where a

plate is worn, are produced in the formation of the letters J, T, D, N, S, L, R, and the combination of S and H, T and H, and C and H. The extreme delicacy of touch possessed by the tongue is well illustrated by the fact that all of these sounds are made by the contact of that organ with the teeth and that portion of the palate covered by the rugæ; or, to be more exact, a transverse section of the superior maxilla at a point between the second bicuspid and first molar of each side would include the whole territory involved in the production of these letters and combinations.

A minute analysis of the theory of the production of these sounds is not necessary to our purpose, though it is a very interesting study, and those who desire to pursue it further will find a most excellent ground-work laid in Dr. Kingsley's paper, read before the New York Odontological Society, entitled "The Mechanism of Speech," and which is the best, clearest, and most practical work upon the subject that has been published, within my knowledge. It is enough for our purpose to have fixed upon the sounds that are located in the territory within which we are working, so that we may be guided in our efforts to prevent too great a change in their quality. In general, the two styles of plates offer nearly the same amount of obstruction *practically*, because both of them occupy a large portion of the space within which the sounds above named are formed. The suction-plate extends further back, but, if properly made, need not have any more influence upon the articulation than the narrower plate supported by clasps. Neither of the plates, if made thin, as they should be, will interfere much with the tongue, provided the edges are fitted perfectly, and if in the case of the suction-plate the air-chamber is properly placed. The most common mistake made in the fitting of suction-plates is that of making the plate too small, which necessitates the placing of the chamber where it will interfere most with the articulation; and, further than this, a chamber so placed is not so effective in retaining a plate.

This is true of all plates retained by atmospheric pressure, and may as well be disposed of at once. The best results, both for articulation and for the retention of the plate, are secured by placing the chamber in the center of the roof, because whatever of natural assistance to the two points under discussion is to be gained may be found there. First, it is the point at which the vacuum is formed naturally by the tongue resting upon the parts surrounding it, and because the two most effective points of the tongue, to-wit, the point and posterior portion, are seldom brought in contact with it.

Second, there are fewer letters which are formed at this point than at any other with which we have to do.

While the shape and depth of the roof have much influence upon the quality of the voice, it is possible to gain sufficient space for our ends without much injury to the articulation by observing the following conditions:

Place the chamber near the center of the roof. In all cases have it conform to the general form of the roof, and so shaped that it shall present no abrupt projections to the tongue or waves of sound which are brought into contact with it.

A suction-plate, made in such a manner, will be found very little, if any, more objectionable from its greater size than a clasp-plate, and will offer very little obstruction to a distinct articulation. One more thought might be added to this part of the subject before taking up the subject of entire dentures. If a plate has a large surface it will be found that too high a polish increases the difficulty of speaking in two ways; first, by the formation of a vacuum between it and the tongue in certain positions, and, second, by the slipping of the tip of the tongue when it should be firmly held. The rugæ form the natural ratchets which assist the tongue in checking sound, and when they are substituted by a perfect plane the result is disastrous to articulation. My attention was called to this fact by an incident which occurred in my practice. A gentleman who is distinguished as an actor came to me for treatment of a perforation of the hard palate, which was of some considerable size. I made for him a plate of hard rubber, quite thin, and large enough to cover the entire hard palate. On trial of it his spirits, which the loss of his voice had reduced to rather a low ebb, immediately rose upon finding his voice so perfectly restored to him, and he immediately launched into a recitation of some length. I observed that some of his words were defective in finish; he said he had noticed the same thing but thought the difficulty would disappear with a little practice.

The plate was made by the "Stuck" method, so that the surface next the tongue was a perfect reproduction of the hard palate, except that I had polished it. As an experiment, I roughened the surface of the anterior portion of the plate and tried it again. The result was so satisfactory to him that he refused to let me have it again, saying, "That is perfect,"—and in fact it was surprisingly effective. Since that time I have adopted the plan of treating plates in this manner, and feel that much greater facility of articulation is

secured; also, that the flow of saliva, which in some patients is very annoying when a plate is first made, seems to be more easily controlled or kept in the back part of the mouth.

In the preparation of a denture for the full arch there are many new points which have to be considered, and in this view the introduction of plastic materials or bases has given us great benefit, and made the art of dental prosthesis embrace a wider and more useful field.

For, while a metallic base has great advantages by reason of its lesser bulk, it lacks adaptability to prosthetic uses, and can only perform the best service when combined with some plastic materials. If we have a case in which the crowns of the teeth only have been removed, or if we are called upon to begin treatment immediately upon extraction of the teeth before any changes have taken place in the alveoli or facial muscles, the most satisfactory results may be secured by the use of a metallic base.

But where the oral cavity has been reduced in size and changed in form, as in the case where the teeth have been absent for a long time, something is needed to restore the mouth to an approximation of a normal condition in its relation to speech as well as conformity to the other features. So much of this matter as relates to esthetic dental prosthesis must be left to other hands for lack of space in this paper, and a glance be taken at what must be done on our side.

If the roots of teeth can be retained in a healthy condition, it is an important consideration and lessens the difficulties by one-half. Or, if we insist upon an immediate restoration as soon as the teeth are extracted, the advantages cannot be overestimated, and ought to outweigh every consideration. The custom of "preparing mouths" for artificial dentures, as it is and has been practiced, has done us more injury than any other thing; and it is the practice of such methods that has placed this department upon the plane it occupies to-day. The work of dental prosthesis should begin immediately upon the loss of the teeth, and should be continued to the full accomplishment of its purpose. I do not mean by this that it is enough to make what is known as a temporary plate and allow it to be worn as long as it will stay in the mouth; but to make a denture that shall fulfill every requirement in form, color, expression, and the best conservation of the functions of mastication and articulate speech, and upon this structure to build whatever is needed to supply the loss of tissue consequent upon absorption. The advantages of this plan are too apparent to need enumeration, and the facilities

for its adoption which are afforded by the plastic bases ought to commend it to careful consideration.

There can be no tenable ground taken against such a position, for the only objections which may be urged are of such a nature as detract from the justice of our claim to the position we should occupy among our fellow-men.

If we could always begin treatment at the earliest period after extraction, there are some things to consider in constructing the best appliance for the purpose designed. The rules which apply to the construction of partial plates have the same application in larger plates or full sets. But the chamber can, in many cases, be dispensed with, and wherever it is practicable it should be. This is an important point, and will enable us to make a plate of uniform thickness throughout that will have but slight effect upon speech.

The crowns of the teeth should be as long and as nearly the shape of the natural crown as is possible; indeed, this may seem a small point, but a very superficial study of the acoustics of the voice will convince one that it has an important bearing.

The form of the sides of the arch should be adapted to the bearing of the tongue upon the bicuspid and molar teeth, as the integrity of many sounds is dependent upon this condition.

In stopping the passage of the air partially, as in the letters TH, R, the holding of it as in D, N, T, or the formation of a tube for its passage through the middle of the mouth, as in SL, SH, ZH, F, and V, the tongue requires the lateral support furnished by these teeth, and the arch must not be too constricted at the sides, nor can it be so wide as to allow of too great spreading of the tongue or the escape of air from the sides. The clear, free discharge of well-formed sounds requires also that no double obstruction be placed inside the teeth, as is often done to assist mastication. If we have followed the true plan of prosthetic treatment we shall never need "plumpers," but if for other reasons their use is deemed of advantage they should never prevent the perfect and easy contact of the buccal walls with the teeth, else they must not only affect the articulation, but the quality of the voice, and their use is one of the most pernicious in its effects in this regard.

If the plastic bases are used for the entire denture they should be carefully made of uniform thickness, and the whole crown of every tooth should be as clearly defined upon its palatal surface as upon the labial or buccal surface, for the purpose of aiding in every way to facilitate clear enunciation.

The edges should present the minimum of obstruction to a correct and accurate focus of the sound proceeding from the larynx. The benefit of following the method which I have proposed becomes apparent in this connection; for having once fixed the point at which the best result is secured for every consideration of facial expression, adaptability to the purpose of mastication, and distinct articulation, the necessary additions are made without prejudice to any of the important conditions, and the final adjustment of the work is easily accomplished by a duplication of the original piece.

On the other hand, if great and almost irreparable changes are allowed to go on for a period of months or years, we may justly be blamed for ignorance or negligence of our duty, though we may exercise the best judgment or bring to our aid the highest degree of artistic skill in attempting a restoration.

The chief basis upon which the advancement of the operative branch of our art is founded is *prophylaxis*, and whether we divide our speciality or not, the highest aim, the proudest achievement in our whole field of labor, will be attained through adherence to this principle in our methods.

SECTION I.—Continued.

Artistic Dentistry vs. Mechanical.

PAPER BY D. G. HARRINGTON, OF THE SECTION.

IT is always well to realize the difference between the ideal and the real, and to place a proper estimate upon each. While there is a great dissimilarity existing between these two principles there is also an intimate relation between them. Divorced from each other and the dental practitioner will either dwell in a *dreamy* land amid unfulfilled desires, or he will descend to the level of an artisan whose work, although mechanically correct, is performed with neither taste nor artistic discrimination. United and accompanied by intelligent application and we have the elements of true success. In every case the artistic should precede the mechani-

cal. Many fail of success because they have no idea what success is. The sculptor must have his model formed in his mind before he can make the cold marble stand forth as a thing of life; or the painter, the true spirit and soul of his picture in his imagination before he can portray nature's most pleasing charms upon canvas. Mind must precede matter, conception the trained hand, or our work will be of the most common sort. It is or should be the object of our schools to set a model of a perfect set of teeth before the student and then proceed to teach him how to conform his cases so far as adaptation to nature will allow to this model. To be sure, no one model is adequate to all cases; indeed, many are needed to cover the ground. But a genuine true model will greatly elevate our tastes, and aid us in bringing our work up to a true artistic standard. Artificial teeth should speak, as well as do the work of mastication; please the bystander as well as give comfort to the wearer. While we cannot dispense with artificial teeth in the mouths of the unfortunate, they should be so thoroughly concealed by art as to give the impression that they belong to the wearer.

When I have made a set of teeth which enables the patient to conceal the fact from his most intimate friends and still elicit praise on account of improved appearance, I feel as though I had achieved success. While success is within our reach in a majority of the cases which come into our hands, there are often many obstacles in the way which we should bear in mind, when we give advice in the extraction of teeth, or criticise the work of others. Extreme openness of countenance, malformation of the inferior maxillary, and sallowness of skin, for instance, are great hindrances to success. Living organs are replaced with those in which there is no life. There is no circulation in an artificial tooth. However perfect it may be in shape, color, size, and adaptation, it is only a dead tooth. Life is only the prerogative of the Almighty. We can supply only in a limited degree what is lost. Again, there is an absorption in many cases of the alveolus, going on until it entirely disappears, causing a sunken appearance both in the upper and lower part of the face which no artificial denture can restore, especially if the patient be deficient in adipose tissue. Bearing these facts in mind, we cannot but feel that it is a great calamity for any one to part with nature's gifts, which were intended for use and beauty, and in too many cases take up with the clumsy contrivances of man. While we adore nature and rejoice in her rich endowments, we often find her ways devious and past finding out. Some are adorned with a

beautiful set of teeth which no neglect or abuse can tarnish or impair, while others suffer from the earliest moments of their lives the most excruciating torments, and never enjoy the use or the ornament of a good set of teeth. An artificial set of teeth that seems to harmonize with nature and is in keeping with the features and complexion of the wearer is a blessing indeed. But those people who go on the principle that a *set* of teeth is a *set* of teeth, so long as they stay in and do the work, often render themselves a public calamity by making an unseemly exhibition of their crockery ware about our streets, and in places of public gatherings. We are reminded of a remark of Dr. Holmes's, "They often look as though they would jump out of the mouth and fasten on you." We prefer to put our subject in this way—the artistic in contrast with the mechanical—that the former element may be more clearly seen and appreciated. There is nothing in our practice which requires more patience, taste, and judgment than the selection and arrangement of a set of teeth. And yet there is scarcely anything said or written upon the subject, and the whole matter is dismissed as a trivial affair, beneath the notice of the rising lights in our profession. Sometimes the matter of articulation and expression can be arranged in a few minutes, or it may require hours; especially if there be a short upper lip, full alveolus and thin cheeks. It is our custom to engage the patient in conversation and then quietly step aside and study the effect. Had we time we should like to enter a little more minutely into the various types and consider the relations of the various sizes and shapes of teeth to these types. Suffice it to say that an artificial tooth should never be quite as large as the natural tooth, because one is a living organ and the other is not, and for that reason one appears more conspicuous than the other.

Upon the subject of color we will venture a few suggestions. It is a wide field for study, and one upon which I do not remember to have heard much said. There seems to be an impression in many minds that the lighter the tooth the more beautiful the expression. A single sister, or perchance a widow passed forty, gazes admiringly upon a pearly set of a smiling damsel of sixteen, clothed in all the freshness and glow of youth, and *wonders* why she cannot purchase these bewitching charms of nature, forgetting that time once lost will never return, whose passage through this world spares neither youth nor beauty, the loss of which no dental art can ever restore. There are two prominent complexions which we should bear in mind—the brunette and the blonde. In their pure state in early life they mark

the two extremes. The teeth of the former are white, bearing upon the straw, of the latter white bearing upon a delicate blue at the tips. Of course, they both grow darker as life advances, but those of the brunette more rapidly than the other. Between these two extremes we have a great variety, shading either upon one or the other. Midway between we often have both types combined in the same person. We often see a person with a dark skin, bearing upon the red, with sandy hair and blue eyes, and others with light, fair skin, dark hair and eyes. For such cases a neutral tint is required, in which the blue and yellow coloring is combined in the enamel, giving the tooth a tint varying from a grayish brick-dust color to a light, muddy white. This last color, varying of course from light to dark, is a color that will match more complexions than any other, and yet it is more difficult to find than any other. We have left our share of complaints at the dental depots, but not much good has been accomplished. We wish some one of commanding influence would try his hand. It seems to us that if as many experiments had been tried in this direction as there have been in the manufacture of gold foil for the last ten years, this want would have been supplied ere this. We find plenty of teeth in which the blue and yellow *prominently* appear, or teeth in which there is no coloring matter at all—whiter than the driven snow. We commend these varieties *either* to the inveterate tobacco chewer, or to those ethereal beings who would be out of place on this mundane sphere. In the style of blocks and shape of teeth, there has been an improvement of late sufficient in variety to reach most cases. There ought to be more sets made with the eye teeth by themselves so as to give the front teeth the right curve. We sometimes snip off the cuspid teeth and put them on separately. I do not belong to that class who preach up carved teeth and speak slightingly of molded blocks as store teeth. If there are but two or three tooth carvers in such a city as Boston, who have an inflexible style of their own, I do not see how you can get as well suited as you would at a dental depot where there are hundreds of styles with endless variations. It looks reasonable that a million of dollars invested in the manufacture of artificial teeth ought to command the best talent in this direction, and would if there were a greater demand for the best work. This demand will come when the best talent in our profession unite in educating the profession up to a proper appreciation of the artistic element. I believe every dentist should know how to carve a tooth, and understand just where to touch a tooth to give it expression, and to know

a natural tooth when he sees one. But to carve and bake a set so as to match every case which comes into his hands is another thing. Let us give more time and study to this branch of our profession, and not leave it too much in the hands of students and assistants. They are more likely to be mechanics than artists. If there had been as much talk and hard work put into the mechanical as into the operative, this branch would not be where it is to-day. Ought it not to be as honorable to attempt to restore the lineaments and expression of the human face as to fill a tooth with gold? One is as mechanical as the other, and either furnishes opportunities for the fullest display of art. As our Saviour delivered an only son to his sorrowing mother, so would we bring back the wonted expression to gladden the hearts of relatives and friends. While we would think no less of the treatment of the natural teeth, we would give more prominence to the mechanical restoration of what is lost beyond the power of man to save.

SECTION I.—Continued.

Artificial Dentistry.—Its Present Status, Prospects, and Possibilities

PAPER BY EBEN M. FLAGG, OF THE SECTION.

I AM requested by the chairman of this Section to speak concerning the present status, prospects, and possibilities of mechanical dentistry. In a profession whose growth is so rapid as that of dentistry, it is difficult to define the boundary of its various departments, and we meet this obstacle at the outset in referring to what is now called mechanical dentistry. Strictly speaking, there is no operation within the range of our profession that does not partake of the mechanical; but all operations performed from the chair, during the absence of the patient, and the work afterward applied to the mouth, whether fixed or removable, have been given the name of mechanical. They may be artistic in the highest sense; they may call for a degree of esthetic culture that few attain: they may be expected to produce effects that nothing less than years of labor

and special talent can produce; but still they are called *mechanical*, and as such we are compelled to speak of them.

These operations include, first, the construction and adaptation of artificial crowns to roots of natural teeth; second, appliances for the reduction of every class of oral deformity; third, appliances for surgico-mechanical treatment of fracture, and other accidents to the jaws; and, fourth, the construction and adaptation of artificial dentures to restore functions and conceal deformities that result from the loss of natural teeth.

To cover all the ground comprised by the above definition would require more time than can be allowed a paper like the present: it must therefore suffice to briefly discuss the question as above presented.

In respect to the construction and adaptation of artificial crowns to the roots of natural teeth, we are able to record a great advance. Much is done every day to relieve patient and operator from what were tiresome and not very fruitful operations. Since the advent of the Bonwill and Richmond crowns many an operation is avoided that meant a sitting of from four to eight hours for the patient, several thousand blows from a mallet, a great amount of endurance on the part of the operator, and a piece of work that had at the best to be used carefully. Thanks to the Richmond operation, we have the presence of the patient for about two hours, and a piece of work whose strength many of us have seen its inventor test by chewing up cottonwood sticks upon it; a test one would hardly dare apply to an extensive piece of gold building. With aged patients, even if their teeth have been preserved throughout life, there is nothing that can prevent rapid wearing down after constant attrition has deprived them of the great mass of their enamel. We do not like to extract the healthy remains, while to restore lost tissue by gold-filling is an operation that nothing but a desperate condition of the patient will force him to endure. It is seldom done outside of America, and indeed it seems too much to ask even an American to submit to. The prospect of mechanical dentistry in this direction is certainly flattering, and we have a right to hope that its possibilities may extend to nearly all cases that are now treated by gold building, so that in the future operations of this nature may be performed in the laboratory, and afterward, at a short sitting, attached to the remaining roots.

Appliances for the reduction of oral deformities involve principles so well known that the status of mechanical dentistry in this

respect is not likely to undergo much change. There is, however, a better prospect of advancement in this direction, owing to increased interest that has been given the matter by books such as Dr. Kingsley's, which call closer attention to a study of the features, and it falls within the range of possibility to make the esthetic a more important consideration in this class of operations.

The present status of mechanical dentistry in respect to appliances for the treatment of fracture and other accidents to the jaws certainly should be encouraging to us as dentists, when we consider the perfection that work of this class has now attained through the mediation of the dental and exclusion of the general surgeon. The prospect now is that in future the dentist will take entire charge of all such cases, relieving the general surgeon of much special study, thereby producing a change greatly to the advantage of the patient.

It would be gratifying to record the same progress in the construction and adaptation of artificial dentures, as in the other departments mentioned; but truth requires a rigid investigation into the present status of this most important part of our work, to enable us to note its defects and suggest the remedy. We should not desire to include praiseworthy effort in a general condemnation, but it seems to-day as though the field of this work was covered by the "injun-rubber-gum-block" system. Go to the dental depots, and you will see the student with the model of a jaw in his hand step up to the presiding deity of the tooth-counter, and say to the aforesaid deity (as he has been previously instructed), "Gimme a set of 'injun-rubber-gum-block' teeth." As form happens to be a consideration in the construction of a denture, the deity of the counter draws out a tray, wherein are some eighty forms, supposed to cover the endless variations of the human tooth. These forms have been turned out by wholesale, molded in rigid metal molds. Can anybody fail to see the absurdity of attempting to produce a portrait of the human mouth on this basis? Imagine living in a world where the extent of variety in the human face was represented by eighty; and after we had seen that number of faces there was nothing to be done but see them over again. How long would it be before the progressive man would turn his thoughts to suicide? Yet this is what we find in the world of artificial dentistry to-day. If we go down to the sea in a ferry-boat, these "injun-rubber-gum-block" teeth meet our gaze. Do we ascend up into the elevated railway, they are there also. They have remained the same for years; they have

become the fashion; in the language of Shakespeare, "Age does not alter nor custom change their infinite monotony." These parodies on the human tooth divine still continue to burlesque the sacred name of Nature. They have become a monopoly, and, like all monopolies, they tend to crush individuality, and flourish in proportion as their victims lack brains. They are the support and dependence of those who advertise cheap dentistry, and wherever the dentist lacks ideality, and is unable or unwilling to devote time to the study of expression, character, and effect, there do these "injun-rubber-gum-block" teeth abound.

A few facts like those just named do not render the present status of artificial dentistry a pleasant subject for discussion; but thanks to the movement now going on for the elevation of art in America, this department, as well as others, is receiving its share of attention, and intelligent people are beginning to inquire "why old Mrs. Brown's teeth in New York look just like young Miss Jones's, of Chicago, or old Mr. Robinson's, of San Francisco?" And why should it be so palpable that they are all artificial? So that the prospect is not bad for a reformation in the matter. But when we as dental artists combine to exact a more thorough course of study on the subject, and compel students to analyze expression, character, and effect, as indicated in natural models, and attach the same importance to it in its way as we do now to the study of physiology, pathology, or anatomy; when an inharmonious expression or discordant effect is treated with the same severity as a case of malpractice in other departments of our work, then, and not till then, can we speak of the possibilities of artificial dentistry.

SECTION II.

Dental Education.

Union of Medicine and Dentistry.

Volunteer Paper by WM. H. ATKINSON.

THERE has been much talk and some earnest endeavor spent in the effort to secure the acknowledgment and recognition by medical men of dentistry as a specialty of medicine, and of dentists as brethren in the healing art. From the time of the efforts of Harris and his *confrères*, in Philadelphia, to induce those in charge of medical colleges to institute a department of dentistry, which, by the way, were ignominiously spurned, there has gradually grown up, little by little, a disposition on the part of medical teachers, and more markedly of practitioners, to reconsider this question. At present there are several well-known universities in which dental departments have been established.

Curiously enough, this course has met with the disfavor of some, who assert that "*dental colleges* are quite sufficient to meet the demands of the times for an educated dental '*profession!*'" At the last meeting of the American Medical Association, a vote was unanimously passed establishing a section for dentistry, which was offered to the dentists, by the appointment of dentists as chairman and secretary to take charge of the section and be ready to make reports at the next meeting.

The International Medical Congress has also set apart Section XII. of its organization for the consideration of the mouth, and given it into the care of "graduates in medicine practicing dentistry." In view of history and in response to repeated requests to say a few words on this subject, I have at last consented to throw together some random views as a sort of starting-point for more thorough and detailed presentment of the subject.

Union is never strictly and fully attained without the loss of individuality to the things that are separate in so pronounced a sense as to make it desirable to bring them together. In so far as there is lack of union in purpose and endeavor to discover and promulgate truth in any department of associate wisdom, the want of concurrent effort on the part of the actors grows out of the stupendous plan of many in one and one in many, which greets us wherever we turn with the desire to know. Truth is one of many and many in one, or, in a word, univariety. Science is arrangement of many in one. Wisdom is the potential holding of each to the other in such antagonism of effort to dominate as to reveal the necessity of alternate *pre*dominance and *sub*dominance of each to the other to secure concurrence of harmonial activity. There are two prevailing methods of study: the first looks at things in the mass; the second attempts to unravel the minutiæ of detail in function and factor of function. When advocates of the first witness an explosion they exclaim: "What an immense power!" The second asks: "Whence the power?" and "What is it?" These are examples of the difference of the depth of the *desire to know*, out of which questions arise. One is content to contemplate externals; the other seeks to penetrate the depths of molecular change. The great lesson to learn is that each must be itself for itself in one sense, and other for other in a second sense; and, further, that no act can be repeated, *per se*, in time or space; but that progress forever obtains, even in the disruptions denominated regress, in finest changes of atoms, molecules, corpuscles, tissues, organs, systems, cycles, and maximal masses.

History is but the disconnected and interrupted footprints of travel over the field of cosmical and planetary progress—the legitimate use of which is as a rudder to guide our little ships on the ocean of advance. Love and wisdom have ever stood knocking at the door of individual consciousness, with locks wet with the dew of the night of ignorance, saying: "If any man will hear our voice, rise early and open the door, we will come in and sup with him and he with us in the plenitude of the satisfaction of the desire to know." The many-ness and one-ness of life and being has been a stumbling-block in the past history of our race only for lack of obedience to the call of love and wisdom to follow the inspirational light within us awakened into activity by the divinity of their presence with us.

Just so soon as the members of professions and other associate

bodies pursuing special activities in the drama of existence shall have discovered that no one can possibly do the work of another, there will be less exclusion and unfraternity of feeling and action among them. Blind, blundering imitations of leaders in methods of study and in execution of purpose by the "accepted" means, to the exclusion of inspirational revelations of truth, born of necessitous circumstances, adapting our perceptions to the need of the moment, is our chief dead-weight in useful career. All that ever was recorded came within our grasp through the mental machinery of those who gave it formal statement. And they perceived it because of a sense of emptiness in the text, and of fullness of inspirational surroundings.

When propositions on any subject become reduced to scientific statement, all minds capable of comprehending them unhesitatingly come into accord. Therefore, wherever there is dissent or denial, the formulation is unscientific (untrue), or those who dissent are unprepared to master the same. How much, then, of the science, biology, can be said to have had this mode of statement recorded in the required clearness? If we would inquire *how* we differ rather than why we disagree, we should be the better peace-makers among the various workers in the departments of the charming field of biological research. For so soon as we see that we must of necessity occupy individual stand-points, we should attempt to put ourselves in the other person's place of observation, that we might legitimately consider his statements. Those who seek the recognition of others in individual or associate capacity, are laboring under the apprehension of that other having something to give that is worthy to be acquired.

Singularly enough, in the experience of mankind, the things illegitimately and unworthily attained have been accorded most attention and highest practical estimate; while those of transcendent value and difficult of acquisition are looked upon with indifference, if not repulsion and disgust, as undesirable. The easy virtue of the indolent is ever ready to follow any lead that may be fashionable, rather than to work out reliable and truthful interpretations that righteousness may become the only tolerable fashion among men.

It is pertinent to inquire as to the special recognition that medicine has to bestow upon dentistry; and the fitness of dentistry to appropriate it to the advantage of those in need of dentists' services. If we are to judge of the ability to recognize and the

worthiness to receive recognition, we should have some well-defined standard of qualification as a guide by which to bestow that recognition. To have this effectual it must be mutual, and to be mutual both parties should be so trained as to be tolerable judges of the qualifications of the other. Inasmuch as such training has not yet obtained among medical men, so as to make their instructions a tolerably unitary code of teaching, and thereby keep them one body, is it a marvel that dentistry is not yet crystallized into a well-defined and demonstrative single code of teachings? In fact, dentists know quite as much of what medical men proper ought to know, but do not, to qualify them to judge cases, as medical men know of what dentists should know, but do not.

A mutual acknowledgment of each other as alternately standing in the position of adviser and receiver of advice will tend to good results. A stilted assumption of superiority on the part of either does not tend to bring out the best knowledge in the possession of the other in consultations. The domination of strong will in the leader in any consultation does not tend to enlightenment so much as does patient presentment of what is apparent upon examination, so as to enable the slow and the weak to comprehend the case as clearly, or fail to make out a diagnosis convincing to all in the council. I am in dentistry as a specialty of medicine to-day in consequence of the prevalence of the dominating method in medical councils, in which I was involved in early practice. Financial and social advantage has been sought too often at the risk of unrighteousness in the decisions arrived at, and detrimental to the patients. It is rare to find old and accepted members in medical practice who are quite ready to meet young men in council on equal terms. In the nature of things this is inevitable as a rule. Fine appearance and a suave manner go further in securing recognition and favor than a well-stored mind in classical and professional lore. This holds even more dominantly in dentistry than in medicine.

Until the general public are better endowed and educated, we need not hope for rapid or great advancement. If required to give an estimate of those whom I deemed best prepared to select professional-council of the dentist for themselves or their wards and friends, I should be unable to select any special class—such as teachers of classics, divinity, law, or medicine—as competent as a *class* over the common people to give sound direction! And this estimate does not exclude dentists as all quite competent.

Union is the product of a felt necessity—a growth and not a

manufacture, hence, all those who attempt to court the favor and the recognition of those already in position of accepted authority, are apt to render themselves less fit for recognition, by devoting time to its attainment that should be spent in qualifying themselves by the acquisition of the knowledge they wish to be recognized as possessing. Whenever and wherever a high estimate is put upon dentistry worthily, I rejoice with a deep gratitude to the Disposer of events among men: for this has been the especial ambition of my professional career. But they "who would falsely win who would not falsely play" can never rise above the level of "mere-make-believe," however numerous the class may be.

The prevailing standard in medicine and, alas! in dentistry is unprofessional, it being "money and preferment" rather than "excellence and efficiency." The same principles that hold the reins in the government of the human body are also regnant on a broader scale in society. The so-called professions are but excerpts of societary unity. Suppose some representative of the medical fraternity should refuse to recognize dentists as part and parcel of the body of healers—would that exclude them from usefulness to those whom they serve to their great benefit and advantage? What matters it for the stomach to say to the liver, "You are not of the body!" or the blood to the lungs, "I have no need of you!" Are therefore these not still essential to each other and to the whole system to complete the round of somatic function? Let us for our own conscience' sake be so grounded in a knowledge of principles and practice as to be able to honestly recognize ourselves as fit to offer our services to the community, then patiently and quietly await the outside recognition, which is sure to come just as soon as those not of us become competent to judge of the qualification that demands and commands recognition by reason of its worth and excellence. Real capacity never seeks for recognition, nor does it reject it where it is legitimate and righteous. Let us then follow Paul's lead where he animadverts upon "holding men's persons in admiration for advantage." Advantage belongs to past stages of a struggling morality, and pertains especially to the immoral and unrighteous aspect of domination, rather than to illuminated governance.

As the latest upheavals produce the highest mountains on the surface of the earth, even so should the latest researches reveal the profoundest truths in science. This is what we claim for dentistry as the blossom of embryological and histological research. It is

the latest specialty in medicine, and includes all that was hitherto known, with whatever is especial in the understanding of the production, decadence, and restoration or substitution of the teeth and the tissues of the entire body. Just as soon as the efforts now making to bring forward *Alwato*, which is the *language* of the new science of *universology*, are completed, we shall be able to justify this claim, and take the lead in exactitude of classification in all science and art whatsoever. All who wish to realize this I would earnestly commend to the careful study of my (rather our) reports on Nomenclature and Terminology made and making before this Association.

SECTION II.—Continued.

Dental Education.

PAPER BY TRUMAN W. BROPHY, OF THE SECTION.

REALIZING full well that the subject of the education of dentists has, during the past twenty years, received the most careful consideration of the leading practitioners in this country, and has been ably presented in almost every conceivable aspect, the question naturally arises in my mind, "Can I advance any idea upon the subject that will be new, interesting, or practicable?" Notwithstanding the numerous instructive and valuable contributions to our literature on this subject, there are doubtless many new thoughts which may be garnered that will enable us to take a few more steps of progress.

Before any marked and general advance can be made in this country, one important measure should be adopted, which is the debarment in every State of incompetent men from practice. Unfortunate, indeed, it is that a uniform law could not have been passed simultaneously in the different States. The difficulty, however, in securing legislative enactments, especially to regulate the practice of dentistry, is such that those who labor in these matters congratulate themselves on procuring the passage of a bill, even though it falls far short of their ideal.

The standard of dentistry, we believe, is advancing much faster

in those States where laws are now in operation than it is in States where such laws do not exist. So long as any man who so desires can enter upon dental practice, even though he does not understand its primary principles, so long shall we have the most formidable opponents to scientific advancement within our own ranks. It is this class that brings disgrace upon our vocation, by rendering thousands toothless through their worthless operations. When laws regulating the practice of dentistry are made and executed in all the States, then we can more effectually aid the colleges and hold them responsible for the professional attainments of incoming practitioners. Advancement in States where such laws do not exist is very slow, inasmuch as the dental student of three months has legal rights to practice equal to those of the full-fledged practitioner; and, consequently, having no inducement to further study, he does not attend college; hence the profession and the laity alike suffer because of his inefficiency. With laws in operation which demand that candidates for admission to practice shall possess a diploma from some reputable dental or medical college—if from a medical college, he should pass a satisfactory examination before a board of censors as to his skill in dentistry, unless dentistry is taught in this college—we may next inquire: "*What should be the prerequisite of the candidate for matriculation* in our professional institutions of learning?" On this subject most of us stand in about the same attitude as the moral philosopher who writes beautiful theories, advises grand actions, but falls far short of living as he directs others to live. Most desirable is it that all who aim to enter upon a professional life, should possess a classical education. Few, comparatively, have enjoyed such advantages. I believe, however—and history verifies this assertion—that any one of vigorous habits, endowed with sound common-sense, with an education such as can be obtained in the free public schools of America, is qualified to enter upon the study of a profession; provided that there is behind this a determination to learn, he *will* succeed and attain an honored place in his profession. The illustrious name of Abraham Lincoln, shining as a bright star in the history of the nation, furnishes us with a striking example of what may be accomplished without a classical education.

No doubt too many students are admitted into our colleges whose educational qualifications are not sufficient to enable them to comprehend the lectures delivered. Substantial advancement we cannot have unless our colleges demand that applicants for matriculation

shall pass a written examination at least in the English branches taught in our public schools; better, indeed, if examinations on the higher branches were required. "Of all the defects in our system of educating men for the practice of medicine and surgery,"—including dentistry, of course,—"none is greater, or productive of more injury to the community and to the profession itself, than this want of preparatory knowledge and discipline on the part of those who enter it. It narrows the field of mental vision; limits the material for comparison and criticism; precludes the possibility of apprehending the philosophy or reason for many things, and consequently compels the acceptance of the opinions of teachers and writers without question; and embarrasses every step of intercourse either with professional brethren or with the community. These embarrassments and limitations to the progress and usefulness of individuals necessarily involve corresponding limitations to the usefulness and honor of the profession as a whole. Improvement here, at the threshold of the profession, is naturally the first and most necessary step towards the accomplishment of needed improvements in all other respects. All must agree that the time when the standard of preliminary education should be enforced is when the student proposes to enter upon his professional studies. First, because the mental discipline and knowledge resulting from such prior education are necessary to qualify him to prosecute his studies with facility and success. And, second, because to permit him to spend three years of time and a considerable sum of money in pursuing professional studies, and then reject him for lack of acquirements which he should have had before he began, would be so manifestly unjust as to need no comment." It is gratifying to know that some of our dental colleges are insisting on preliminary examinations, and that they do not hesitate to debar from matriculating those who cannot pass. It is hoped that this example will be adopted and faithfully carried out in all the schools.

Is dentistry a profession in itself, as some of our members contend, or did this Association put itself in a ridiculous position by asserting many years ago and embodying in its Code of Ethics the clause, "Dentistry is a specialty in medical science?" We respect too highly the framers of our Code to question their veracity or judgment, or doubt their motives. If "dentistry is a specialty in medical science," as we most candidly believe, then it is absolutely impossible that it be a profession in itself; and whoever makes use of the term, the "dental profession," is invariably in error. With equal

propriety we might speak of ophthalmologists as being members of the ophthalmological profession, etc., etc. If dentistry *is* a specialty of medicine, every dentist is, or rather ought to be, a medical man. The question, however, is frequently asked: "Is not the man who constructs artificial dentures a dentist, and do you assume that he should devote three years to the study of medicine?" This scarcely needs to be answered; the most careless observer practicing dentistry must realize that operative and mechanical dentistry are as incompatible as operative surgery and the manufacture of surgical appliances. Mechanical dentistry is quietly but most surely drifting away from operative dentistry, so that we might safely say that comparatively few members of this Association practice both the operative and the mechanical departments. The mechanical dentist should possess artistic mechanical skill; he should be well versed in the chemistry of the metals; have a thorough knowledge of the anatomy of the muscles of expression; be thoroughly instructed in manipulating the materials of which artificial dentures are constructed; and be able to select and arrange artificial teeth in imitation of nature's forms. It is not, or should not be, within the province of his duties to treat oral diseases, not even the diseases of the teeth themselves. The high art which he must be competent to execute, if he expects to be successful, does not require a knowledge of the principles and practice of medicine to insure the most satisfactory results, no more so than does the manufacturing of artificial eyes, or of any substitute for other lost portions of the anatomy. On the other hand, it is generally conceded by well-educated practitioners that a knowledge of the principles and practice of medicine and surgery is absolutely essential to the successful pursuit of operative dentistry. No one can practice dentistry successfully without practicing medicine constantly. The very nature of the work required is such that the practitioner cannot well change from laboratory to operating-room at frequent intervals, as is necessary when carrying on both departments; besides, the highest success in the art of mechanical dentistry cannot be attained without long and careful study. In a word, mechanical dentistry in all its branches is so high an art, and requires so much time to master its intricacies, that it is absolutely impossible for the student to gain a knowledge of this and the operative department—in the time required by our dental colleges—necessary to practice both successfully. Therefore, I believe that all students who aim to practice in cities or towns of considerable size should resolve to practice

exclusively one or the other branch. If, however, they should choose to practice in the country, they should, of course, be able to construct artificial dentures in conjunction with operating; with this in view, and a growing demand on the part of dentists for a knowledge of medicine, we believe that the cause of dental education would be greatly advanced if the learning of mechanical dentistry were not made compulsory in our colleges, and the time now devoted to it were spent in the pursuit of medical studies.

The demand for medical knowledge among operative dentists is increasing with such astonishing rapidity, and with equal rapidity is it that artistic mechanical dentistry is passing into the hands of experts in this department, that there should be a change made in the curriculum of our colleges to meet the requirements of the students as well as the community which in time will employ them. *All men who aim to practice operative dentistry should receive a full medical education*, and enter upon the specialty of dental surgery with a knowledge of the underlying principles of medicine and surgery equal to that possessed by other specialists. If they desire to be mechanical dentists they can devote themselves to this department, and when found qualified receive a certificate to that effect.

Dental surgery, properly practiced, is a specialty in medical science, and therefore should be taught as other specialties are in medical colleges. Ah! but, some one says, how absurd it would be to attempt to teach dentistry in a medical college, whose professors know nothing of it. What! teach dentistry in a medical college, the very atmosphere of which impresses the dental student as though a stranger in a foreign land! With equal propriety the same argument a few years ago might have been made or urged against the teaching of ophthalmology and otology in our medical colleges. Indeed, it was within the last century that surgery was first recognized in England as being worthy of a position in the medical profession, as worthy of being taught in the medical schools. We hear from those who advocate the present system of teaching dentistry that too much time would be required to educate a student in medicine, including his dental training. Let me ask, What is the curriculum embraced in our dental schools? It is the teaching of filling and treating diseased teeth, constructing artificial dentures, and imparting a partial medical education, followed by conferring a degree that few understand to mean that the possessor is a professional man. The importance of educating dentists in medicine was fully recognized by the pioneer dental teachers of our country. How

enthusiastically did the late Dr. Chapin A. Harris, he whose name we all love and venerate, with his associates, labor to establish a department of dentistry in a medical college in Baltimore! And no doubt those of our elder brothers with us to-day who knew him well could relate to us the expressions of bitter disappointment that fell from his lips when he saw that his fond and just desires in the interest of suffering humanity, owing to the opposition of the medical faculty, could not be realized. The great error committed by this medical faculty had the effect of isolating the teaching of dentistry. Had Dr. Harris been successful in establishing chairs of dentistry in a medical school, the dental college probably would never have been established, and the influence of the medical profession, embracing dentistry, would have been greater; dentistry would have been more respected, and its sphere of usefulness doubtless would have been far more extended; as medicine advanced, so would dentistry. The memory of this unfortunate event in the early systematic teaching of dentistry engendered feelings of animosity between the medical faculty and the dentists immediately interested that still finds place among men who are unable to forget mistakes, and who seem to regard this error of medical men forty years ago as a sufficient cause for refusing medical education to dentists, and consequently retarding the advancement of dentistry for all time to come.

In 1839, when our first dental college was organized—the Baltimore College of Dental Surgery—there were but four professors, all medical men. Chemistry, microscopical anatomy, histology, materia medica, and surgery were not a portion of their curriculum. The demand, however, for more knowledge in the above and other branches, has been such that from time to time additions to the faculty and to the facilities for teaching have been made, so that at the present time, in the best of our dental schools, we not only have the above branches taught, but the chemical laboratory, the dissecting room, and the physiological laboratory have been established, and the attainments of recent graduates attest the superior advantages they have enjoyed, compared with those of their less-favored predecessors.

Gradually the standard of dental education has been raised, till now many of our profession believe—and their belief is shared in by some of the most distinguished professors in our dental schools—that dentistry should be taught in our medical schools, and that our dental colleges now in operation should unite with the medical colleges,

utilizing the teachers in both, so that the greatest good may result in making our students educated professional men. There is a class of diseases met with in the oral cavity which the general practitioner is not as a rule qualified to treat, since he has not been instructed in the pathology of the teeth; neither is the dental graduate qualified to treat them, since his knowledge of general pathology is not sufficiently extensive to enable him to appreciate and successfully antagonize unfavorable local or constitutional symptoms that might arise. Therefore, the unfortunate patient afflicted with such oral lesions is sent by the physician or the general surgeon to the dentist, since the surgeon does not understand the case, but believes the dentist can give relief; and the dentist, not being acquainted with the character of the affection, remands the patient to the physician or surgeon from whom he came, saying, "I am unable to associate the affection in this case with the teeth." The patient consequently obtains no relief, for the reasons that the physician has not been educated in dental diseases, and that the dentist has not been educated in general diseases. Moreover, if the physician acts on his own responsibility, and there exists in his mind the least suspicion that the teeth may be the cause of neuralgia or other affections, too frequently he advises their extraction; and the dentist, for the reasons above stated, extracts them without hesitation, although the operation may not be warranted or at all advisable. For these reasons the students who aim to enter upon general practice, as well as all specialists, should be educated together in the medical schools.

If mechanical dentistry is not made compulsory, the medical colleges, by adding efficient instructors in the principles and practice of dental surgery, are far better adapted to teaching the dental student than the dental schools as now organized. Let the dental student take a full three-years' course in a medical college; let him attend all the lectures; let him, while those who aim to follow a general practice or some other specialty are receiving instructions in their departments, be present in the dental infirmary receiving practical lessons under the guidance of efficient demonstrators; let this be done during a period of three years, after which he may come up for examination, and, if qualified, receive the degree of M.D., a title which is sufficiently broad to cover each and every department of the healing art, and under which all practitioners, either general or special, are recognized as members of a time-honored profession which ranks first in point of usefulness among the learned professions of the earth. As other students receive certifi-

cates from special instructors, so too should he who has qualified to practice the specialty of dental surgery. We need not fear that dentistry, as some contend, would be degraded by thus teaching it; on the contrary, it would immediately take a more exalted rank in the estimation of the community. It would be no longer regarded as a mechanical trade by many intelligent men, but would take its position on a level with other departments of medical science.

DISCUSSIONS.

Dr. Litch: The leading thought in the paper just read by Dr. Brophy seems to be that the time has now come when dental colleges as such should be abolished, and dental education be sought for in medical schools, or under the patronage and supervision of medical schools. While I agree with the doctor in the opinion that the ideal education for the dentist is a thorough medical education as a foundation for special instruction in dentistry; while I agree that that is desirable in every way, I can hardly agree that just at the present hour and time it is fully attainable; and I furthermore disagree with him in the assumption that dental colleges, as at present organized—the best of them—do not very well qualify the dental practitioner for his special work. Our best dental colleges have a chair of anatomy, of physiology, of general chemistry, and of materia medica, which are the four fundamental branches of medical science. The ordinary medical school has, in addition, a chair of practice of medicine, of obstetrics, and of general surgery. We all recognize the fact that, while it is important that the dentist should understand the principles which underlie general diseases and their treatment, it is not essential that he should have a very thorough knowledge in reference to the details of such treatment, or of the details of the practice of general surgery, because it is outside of his domain. He should know the principles, and if he knows the details fully it is helpful—desirable, perhaps—but not absolutely necessary any more than it is for the practitioner of medicine to have a knowledge of the technicalities which make up the dental specialty. The physician should know the principles of dental physiology and pathology, of which he is at present abundantly ignorant, but we do not expect the practitioner of general medicine to grasp all the details of the dental specialty. Furthermore, I contend that the medical curriculum, as at present arranged, is not

adapted to the needs of the dentist, for the reason that in that curriculum dental physiology and pathology are almost absolutely ignored. A gentleman, who is not now present, but who is a distinguished member of the dental profession, said, in a paper read one year ago, that in a three years' medical course in a leading medical school he had failed to hear one respectful reference to dentistry or dental pathology; and I think that that will be found to have been the experience of every dentist who has graduated in medicine. That at least has been my experience. One need but turn over the pages of our medical text-books to see how very meagre is their information in regard to dental pathology and therapeutics, and if it is true of text-books, it is true of instruction in schools. Take up a medical text-book on the materia medica, and you will find in the whole list but two or three allusions to the use of drugs in dentistry. You will perhaps find the century-old advice that oil of cloves is good for toothache; but certainly not a hint as to the pathological condition in which it may prove alleviatory. Dental surgery is as entirely ignored as though there was no such thing as a tooth. The medical course, then, as at present arranged, cannot be said to give the proper training for the dental student, because the course is built up for the education of medical practitioners and not of dental practitioners. Until a little more progress is made by the medical profession, in recognition of the claims of dentistry to be ranked as a legitimate branch of scientific medicine, it is better not to abandon the old schools, which have done so much towards advancing dentistry to the standard it at present occupies. Dentistry is a fine baby; she has attained her present growth and proportions under the jealous care of those who loved her; let us not intrust her future to the tender mercies of a foster-mother who has proved herself to be either contemptuous, indifferent, or mercenary; contemptuous except in so far as she is indifferent, and indifferent except in so far as she is mercenary.

Do not understand me as ignoring what measure of recognition the claims of dentistry are now receiving from the medical profession; but we must recognize the fact that there is on the part of medical men a wide-spread disbelief and incredulity in regard to the validity of those claims, and this skepticism is largely the result of ignorance on the subject; because only the men actually engaged in work in the dental field can realize the extent of that field, and only a man so engaged can realize how absolutely essential to the highest success in that field is a broad scientific culture. This

of course, medical practitioners are not capable of fully appreciating, although I think the time will come soon, when they will have a fuller realization of this truth; but until that time comes let us not trust dental education in the hands of men who are not prepared to insist upon its thoroughness because they do not recognize the necessity for thoroughness, and who have not even that incentive to strictness of requirement which an honorable *esprit de corps* must give.

A great deal has been said about preliminary examinations. This I hold to be desirable, but it is not required in a majority of our medical schools, and until it is so required dental schools can hardly be expected to set up a higher standard. I do not hold a classical education to be essential, although I consider that it is desirable and eminently helpful to the student in every domain of science, especially in medicine, because the nomenclature of medicine is so based on classical languages that the ordinary student has a great many difficulties to overcome without a knowledge of the Greek and Latin tongues. With an ordinary good English education, however, a very fair amount of progress can be made. A large proportion of our physicians and surgeons have started without any classical training, and many have acquired it in the course of their studies.

In regard to the separation of the mechanical and operative branches of dentistry, I think that while it may be eminently desirable it will be found impossible of attainment, as a rule. It answers very well in large cities, but the gentleman who should settle in an ordinary country town or village, and confine himself exclusively to the manufacture of artificial teeth, would pick up a very meagre living. This is not practical in the dental profession any more than in the medical profession. How would a man thrive who went to a village to make a living by treating diseases of the eye alone? It is eminently proper that there should be specialists in ophthalmology in large cities, but the general practitioner in the country must be such in every sense of the word. The average patient is not able to travel hundreds and thousands of miles for the treatment of ordinary lesions of the eye, while an inhabitant of the city naturally seeks the advice of an ophthalmologist.

This is true also in regard to dentistry; the average practitioner must be a general practitioner in order to meet the requirements of his patients and secure for himself a livelihood. A higher degree of skill in either branch can, of course, be attained by an exclusive devotion to either; but the average man can do good work in both;

and I repudiate the suggestion that there is anything derogatory in either, or in one more than in the other.

A few words in regard to the matter of laws for the regulation of the dental practice, which were alluded to in Dr. Fillebrown's paper. It is one of the most potent influences for securing the advance of dentistry which we can have recourse to. The securing of intelligent legislation upon the subject, as was stated by the gentleman, is a matter of immense difficulty. Legislatures have to be organized in the interest of such bills with almost as much care as in the interest of a corporation, and as there is not so much money back of dental acts they do not get through so easily as great corporations with their bills. There is, too, great difficulty in enforcing legislation when obtained, owing to the laxness of public opinion. In Pennsylvania, a committee appointed to bring cases of infringement before the courts brought two or three suits; the plainest and most palpable cases of infringement went before the jury, and verdicts were brought in for the defendants in spite of the law and the evidence and the charge of the judge, and only because of the lax public opinion upon the subject of dental legislation.

Dr. Shepard: Criticism of the present methods of education, and suggestions for their improvement from those not engaged in teaching are of value and should be gladly received; yet it is true that such observers cannot understand as well as those who have had years of experience in teaching what are the difficulties to be encountered and overcome and the hindrances to advance.

The chief difficulty in carrying out the idea of the second essay is that up to the present time our profession does not attract a class of students who have the pecuniary ability to afford a long course of professional study. It is also a fact to be regretted that few young men who are classical graduates enter the dental profession. When the time comes that our calling is sought by such men, as will doubtless be the case by and by, this difficulty will be removed. There is no doubt that every advance in the breadth and thoroughness of our educational methods is hastening that day. But that this time is remote is shown by the fact that but a minority of those yearly entering our profession avail themselves of the training of our dental schools, where courses are short and easy in comparison with those of the medical schools, and of this minority the majority select the easiest and shortest courses. I ask those qualified to judge if this is not a fact of observation. If it is, we certainly have a condition of things which makes the adoption of the medical

course still more difficult. Another objection to the second paper is that it attempts to set aside the arithmetical truth that more cannot be crowded into any three years than said years will contain. If it is true that a medical course requires three years of actual study, how can the student properly acquit himself in these studies and so master them as to successfully pass his examination for his degree of M.D., and during the same three years have time for his special dental studies and the acquisition of manual dexterity so as to be qualified with the skill necessary to perform dental operations? According to arithmetic, such a student must be more talented and more diligent than one preparing for medical practice simply, or he must neglect some parts of the medical course and hence be less thoroughly educated medically than the other; or we must conclude that the requiring of three years for a medical course is not necessary and gives a student much spare time. The only position for those favoring the full medical curriculum for dentists to take, is to advocate the addition to the three years of another year, which should be devoted to special study and practice in the infirmary.

In the institution with which I am connected there is no distinction between the medical and dental students during their first year of study. The whole year's work in anatomy, including dissection, physiology, and chemistry, is identical with the same examinations at the end of the year and the same requirements for successful results. We have demonstrated that our students cannot fulfill these demands and at the same time do any extra work in dental study or practice. Hence they are advised not to devote any of the first year either to the laboratory or infirmary. At the end of the first year the dental student branches off from the medical student and devotes all the second year to dental study and the acquisition of manual dexterity; some even find they must remain a third year to pass all the examinations. In the medical school its second and third years, in like degree, engross all the student's energies and leave no time for any specialty.

The essayist makes a grave mistake when he states that the specialist in dermatology, otology, etc., is prepared for practice when he graduates as an M.D. It is a fact, on the contrary, that the great majority of such specialists devote much time, after graduation, in special hospitals, at home and in Europe to the acquisition of their special training and skill. Many whom I know have spent years abroad, after graduation, at the clinics of the masters of their specialties, before they considered themselves qualified to practice. No

fault could be found with the advocates for the full medical curriculum for dentists if they would urge such a system. They would then be consistent, for they would be advocating a higher education instead of making less thorough and broad medical training.

Dr. ODELL: In the paper, or in the remarks of the speaker that followed the paper, it was stated that "no remark was ever heard in any medical college referring to dentistry in a respectful manner."

Dr. LITCH: My statement was that a distinguished practitioner had made the statement in a paper read a year ago, that in attendance upon a two or three years' course at a medical school, he had not in the whole time heard a single respectful reference to dentistry.

Dr. ODELL: Then I was wrong in imputing the remark to the speaker instead of to his quoted authority. In our New York University Medical Department, however, I must beg to assert that there was a continual reference to dentistry, wherever it was admissible, wherever it was possible, in some connection, either with the teeth, or often as low down as the pelvis. I remember very distinctly that the chair of obstetrics recognized dentistry; for in my examination the very first question was, "What do you know of forceps?" That was only preliminary to putting me through the various positions, but there was an allusion to dentistry there very plainly. When I came before the professor of microscopy, he did not dream of asking me anything out of the teeth; it was *all* teeth, and I was disgusted with such continual reference thereto. I expected to be examined on what I had been "cramming;" he examined me on what I had "crammed" years ago, and pretty nearly crammed me into trouble. I merely beg to give credit here where it is due, because, in the sweeping charges made against one college or claims made for another, we are apt to take such very broad ground that we leave out some facts, and we fail to give some parties credit, while we claim the credit for ourselves, or our individual institutions.

Dr. STOCKTON: I believe the higher the education of any man for any calling in life, the better he will perform the duties devolving upon him. If I had to begin dentistry again, I would become a thorough medical man. I would thereby have more confidence in myself, and the confidence of the community would the more easily be secured. While dentists should know much more of general medicine than many of us do, medical men, too, should know something of the matters pertaining to dentistry. And this is illustrated by an incident that occurred only the other day. Some

months ago I filled the two lower sixth-year molars for a little boy; they were very badly decayed, and I filled them only for the purpose of keeping them until a proper time for their extraction. The pulp in one of them unfortunately died, and ulceration was threatened. The little fellow suffered considerable pain, and his parents sent for the family physician, who did just what other non-dentally educated physicians have done in similar cases, advised a warm external poultice—the very worst possible thing to do. The face swelled, and when suppuration had taken place, he lanced it externally, thereby leaving a scar for life, and then said, "As soon as the swelling subsides, you had better go to your dentist and have the tooth extracted, for there is danger of *periostitis*." Now, I think the doctor wanted a little dental education. I said to the father, "I am your dentist, and hereafter when anything is the matter with the teeth, come to me or send for me. I do not propose to interfere with your physician in any of *his* duties; neither do I want him to interfere and do harm when I can so easily prevent it." I believe in a medical education for dentists, and also in considerable of a dental education for physicians.

Dr. Brophy: I desire to answer briefly the remarks made by the gentlemen who have discussed this subject, and I ask your indulgence for a few minutes. I would like to ask the definition of the word *dentistry. What is dentistry?* I ask Prof. Litch.

Dr. Litch: It is the art and science of treating diseases or pathological conditions of the teeth.

Dr. Wetherbee: I hope he will amend that, and allow it to cover more ground. I think it is the science and art of restoring abnormal conditions of the oral cavity to a normal condition.

Dr. Litch: It seems not.

Dr. Brophy: Artificial dentistry, then, according to Dr. Litch's definition, is not dentistry, since he says: "Dentistry is the art and science of treating diseases or pathological conditions of the teeth." I asked the question of Dr. Litch for the reason that I desired to challenge an assertion he made, which was, that medical men generally know very little of dentistry. I wish to quote his words as nearly as possible. If this statement be true, if medical men generally know very little of dentistry, then anatomy, physiology, chemistry, pathology, therapeutics, materia medica, and hygiene have nothing to do with dentistry, for it is generally conceded that the average physician knows far more of the branches of science mentioned than the average dentist.

If medical men know very little of dentistry, why are there so many of them holding professorships in our dental colleges?

If medical knowledge is not necessary to the dentist, the teaching of the branches just named should be abandoned in dental schools. Dr. Litch assumes that the practice of dentistry is based upon a knowledge of pathology and therapeutics, and yet he says that physicians know very little of dentistry.

Dr. Allen says the time has not come to teach dentistry in medical colleges.

To answer this statement in full would necessitate a repetition of a portion of my paper. I have no desire to consume your time to that extent. I refer you to my paper in regard to that matter. No one will claim that a recent graduate from a medical college is an educated practitioner; that is to say, an eminent practitioner. Eminent practitioners, either general or special, are not made in medical colleges. The *foundation is laid there*, upon which the young man may build a reputation that will place him among the foremost in his profession.

The medical schools instill into the minds of their students the *principles* of medicine, without a knowledge of which the practitioner is ever in the dark, and consequently cannot succeed. The understanding of these foundation-principles is essential to the dental specialists as to other specialists and general practitioners. Well grounded in these principles, the student can intelligently pursue special studies in whatever department of medicine he may select.

We do not want young men to come out from the dental schools without first acquiring a knowledge of the principles of medicine upon which to build the specialty of dental surgery. It is, indeed, impossible to thoroughly understand special pathology or the pathology of the teeth and associate parts without first attaining a knowledge of physiology and the principles of *general pathology*.

The teaching of dental pathology, without first teaching the principles of general pathology, might be compared to attempting to build the roof of a house before the foundation is put in place. It has been said that a knowledge of medicine is not necessary to the successful practice of dentistry; that dental students have not the time to pursue medical studies. Why, I ask, are so many young men, graduates in dentistry, taking a medical education? Why are so many going from dental schools to medical schools and taking a full education in medicine and surgery? For the reason that they do not get what they need in the dental colleges to enable them to practice dentistry in a manner satisfactory to themselves. I do not wish the

impression to go out that I am opposed to the dental schools, or that I am speaking disparagingly of them. I owe a great debt of gratitude to my dental *alma mater;* yet I sincerely believe that if medicine were taught in those schools, or if the dental professors were connected with medical schools of high standing, every student receiving such advantages and such training would be better qualified to practice the specialty of dental surgery. It is absurd to say that the dental student has not the time to include, during his college course, the whole curriculum of medical studies, or to assume that he requires more time in college in preparation to enter upon practice than is required by the ophthalmologist in preparation for the practice of his specialty. Dentistry is no more profound a science and art than ophthalmology. Let me ask you what would be the standing of the ophthalmologist if he were to commence practice without having taken a full medical course and contend that he had not the time to do so; besides, the eye was his specialty, and he had no desire for a knowledge of the other organs of the body? Dr. Shepard has said that few young men attending his college are willing to enter upon a prolonged course of study, such as is required of the medical students; that they have neither the means nor the preliminary education, in many instances; and that they are not from families of culture, position, and wealth. This is not only true of his school, but the same condition of affairs exists in all the dental colleges. Why is it so? It is for the reason that they do not regard the study of dentistry worthy of their attention.

When the dental department of Harvard University (as well as other dental schools) requires as a prerequisite to matriculation an examination equally as searching as the one to which the medical students of the same university are subjected, educate their students as thoroughly, and confer a degree which is recognized and generally understood in our country to mean that the possessor is a professional man, there will be no dearth of young men of family, position, and wealth pursuing the study of dentistry. So long as the dental department of the time-honored university with which Dr. Shepard is connected is willing to accept students who have been rejected by the medical department, or debarred from matriculating therein, so long he must expect that young men of family, position, and wealth will not be found among his students.

About the three-years' course of study: I do not expect a young man, a recent graduate, to be an eminent practitioner. We expect, however, that after he has pursued his studies three years, as indi-

cated in my paper, he will have the principles underlying the practice of medicine and surgery, coupled with a knowledge of the principles of dental surgery, thoroughly incorporated in his mind, and the same practical knowledge and experience which he now obtains in the dental infirmary. In order to attain the highest success, young men who aim to follow specialties must have well-directed special study in the department they have chosen. It is as proper that the dental graduate should be especially trained under the guidance of competent teachers after passing from the school as it is for other specialists. This post-graduate training, I believe, can best be conducted in private offices, where so much is to be learned that is essential to success in practice.

Dr. Shepard: You state you agreed in having a supplemental course; you are contending that it should be done in three years.

Dr. Brophy: I contend he would be better prepared to practice in that time, and in the manner I have advocated, than he would be under the present system of dental college management. On the subject of artificial dentures, I agree with Dr. Allen. Every gentleman who spoke said artificial dentistry was so high an art that young men cannot acquire a knowledge of it which will enable them to practice it successfully within the time required to graduate from college. We have only a few artificial dentists in Chicago who are eminently qualified in that department.

About the dental law: While it may be difficult in all cases to enforce it, it has, in all States where it exists, a very good moral effect.

The advantages, Gentlemen, which would be derived by the community, and the certainty of our true advancement by having the dental students and medical students all educated together, so as to enable them to better understand the relations which exist between the organs of the human body when invaded by disease, are so clear to my mind that I see no ground for argument.

Dr. Hunter: It appears to me that we underestimate the importance of artificial dentistry when we seek to divorce it from operative dentistry. It has been plainly shown that when a person is in need of artificial dentures, the best judgment, the highest artistic attainments and integrity are essential to retrieve the loss of the natural organs in restoring the features, expression, enunciation, and mastication; and, instead of degrading and assigning it to charlatanism, and making it a mere mechanical trade, and throwing it out of our colleges, there should be even more pains taken to develop the skill and fine art properly belonging to that important branch of our profession.

To overcome the evils complained of, our methods of thought and practice need to be reconstructed.

No dentist should take an office-boy or student (for the office-boy too often graduates himself, and dubs himself doctor or surgeon-dentist in pretentions hand-bills, and warrants all work, and then begins his evil course) unless he is gifted with natural mechanical and artistic faculties of a high order, together with good intellect and undoubted integrity. For without those gifts by nature, it is as impossible to become a competent dentist as to make gold from the baser metals, or to make a good and honest man of a Guiteau, in whose constitution fiend was indelibly stamped before his birth. So, let us begin at the right time and place to make good dentists. Let us commence with good material in our offices, instead of examining for color-blindness or other disqualifications on application to enter college. Too much time is then thrown away by the young man, and he is subjected to mortification and injustice if found incompetent, after having been allowed or encouraged to make an abortive effort to become a dentist. It would be better to be able to tell a young man what calling he is or is not adapted to engage in for a life-work, than to do him, the dental profession, and society wrong.

Dr. Shepard: The essayist, and those who have spoken in favor of the M.D. course, fail to give us a very complete presentation of their plans.

It is a fact also that the training of our medical schools is defective in many respects, notably so in regard to the teeth. The eye, the ear, and the skin receive much attention; dental tissues almost none. The young men preparing for medical practice should be as thoroughly instructed in the latter as in the former. The medical school would then be complete, with no distinction between one specialty and another.

The possessor of this broad education would then, after graduation, perfect himself in his specialty at the proper hospital. It is much to the discredit of all medical schools that they turn out men as educated who are so ignorant of such important organs as the teeth. All of us know that the ignorance of medical men about the teeth and their diseases is most lamentable, and brings much suffering and loss to the community. Our first efforts should be to have in the medical curriculum proper dental teaching for the young physician.

We ought also to condemn the custom of some medical schools of advertising their offer of the M.D. to graduates of dental schools

after one year only of additional study. Is any one so foolhardy as to assert that two years in a dental school and one year in a medical school are equivalent in medical training to three years in a medical school?

We all know that this plan is a cheapening of the M.D. degree. Because a man is to practice dentistry, should he obtain his degree of M.D. with less medical knowledge than he who is to practice medicine? The selling of a degree which means a definite thing to one man upon certain conditions and to another upon less is a fraud, and the parchment tells a falsehood. One is a full education and the other a partial education. It can only be made legitimate and honorable by the proclamation from medical sources that medical education is changed from former customs, and, like our classical institutions, has elective studies from which the student can select which he will follow and which ignore.

Dr. Butler: Does Harvard offer such terms?

Dr. Shepard: It does not.

Dr. Buckingham: Do they not take the dental graduate on better terms than the outsider?

Dr. Shepard: The candidates for the M.D. and for the D.M.D. pursue their studies the first year together, no difference being known between them in their studies or in the examination at the end of that year. The dental student then takes his second year in the dental school, and, if successful in his examinations for that year, also gets his degree of D.M.D. If now he wishes the M.D., he goes back where he left off at the end of the first year of the medical school, and takes the whole second and third years in that school. His second year of dental study does not count for the medical degree. This, as you will see, makes four years for the two degrees. Some go through the full medical course of three years, and then take the last year of the dental school, which is the same thing, only varied in order.

Dr. Buckingham: Can they take the two years in the dental school and the same in the medical school at the same time?

Dr. Shepard: I should say not; certainly none ever have. The hours of lectures, etc., are not so arranged that one could. The studies of the second medical year and second dental year are distinct.

Dr. Buckingham: Can he by law?

Dr. Shepard: My impression is that he cannot by law be a candidate for both degrees at the same time. But a student in any department of the University can attend the instruction in any other department or all the departments if he can find the time.

Dr. Butler: The principal argument that has been used in the remarks on the essay on dental education, I think, is one of the poorest to be brought before such a body. The day is past when there is any necessity of endeavoring to bring men into a profession, whether it be medical, dental, or any other, by the short-cut, or on the claim that they cannot afford to spend the necessary time for proper preparation. Now, it would be a very poor argument to bring before a body of mechanics, to say that a man who wanted to engage in the art of harness-making, or as a machinist, should be sent out as well qualified on two years' apprenticeship, when three years is considered only sufficient to obtain the rudiments. The time has fully come when we should insist upon at least a high-school education, as preparatory to entering upon a course for a professional life where health and life are to be committed to its keeping. Has not experience taught us that with the best possible dental and medical school curriculum, faithfully observed, but a small per cent. succeed in becoming skillful members of the profession in medicine or dentistry? With these indisputable facts before us, I cannot see any demand for recruits that cannot attain to a high standing. Much criticism of the dental and medical colleges, also of the dental departments of universities, for graduating poorly-qualified men, has been indulged in; but I apprehend that the mistake is made by the would-be preceptor, in encouraging young men in the study of dentistry and medicine that have no aptitude for a professional life.

Dr. Litch: I merely wish to occupy the time for one moment, and that is in reply to Dr. Brophy. He asked me the definition of dentistry. I gave a definition which I think a perfectly good one, namely, that dentistry is the art and science of treating pathological conditions of the teeth. He claims that by this definition I admit the correctness of his position, that the making and insertion of artificial teeth is not a legitimate branch of dentistry. I will not now discuss the point whether the absence of teeth constitutes a pathological condition of those organs or not, or whether the insertion of an artificial denture can be properly deemed a means or method of treatment. I believe that it should be so deemed, and that, all quibbles apart, the artificial denture has its place in the limits of the definition I have given. But there is quite a large class of cases in which the wearing of an artificial denture is one of the best and often the only means of treating pathological conditions of the teeth, *in situ*. Such, for example, are cases of abrasion owing to excessive use arising from the loss of contiguous teeth. The so-called operative method of

treatment would, I suppose, be to undercut and cap the crowns with gold. The so-called mechanical method would be the making and insertion of an artificial denture to supply the place of the missing organs, and thus relieve the abraded teeth from the abnormal wear to which they had been subjected. Either is a method of treating a pathological condition, though why one should be called operative and the other mechanical I leave to others to explain.

Dr. Atkinson: I have a few words to say. It is quite time enough for us to show our preferences when we have any one *standard profession* that is accepted and respected. And when we shall have had a university that is independent of the money paid to the professors or teachers, we will then have started the first foundation for true teaching in dentistry or medicine, or any other department of science. But great mistakes in legislation have loosed the very foundation of conferring degrees, by allowing incompetents to charter other incompetents to teach. We have been lying from the first to the last. There never was an M.D. or D.D.S. honestly conferred on earth. If you would give certificates of advancement, that would be something. The idea of the money being used to induce those that are commissioners to confer a degree they would not get if the degree was not conferred! That has done most of the mischief. The next mischief is nepotism. There is where it lies. If you allow any man who thinks he knows anything and a person who does not know anything about it to converse about the science they are examining him in, you need not be afraid of graduating ninnies or incompetents. I tell you I do not know a single faculty—if not acquainted, and they were allowed to examine each other—that would not each ignore the other. I know what I am talking about. Suppose we could take them as they stood, to know nothing about them, and by that examination I guarantee not one of them would get a degree.

Dr. Abbott: I would impose, in addition to a severe examination at the end of pupilage, a preliminary examination, to be a test of the fitness of the applicant to become a student. I have just received a letter from a young man with reference to entering a dental college, and in my answer I shall suggest that he go to school awhile first. I should examine, if I had only ten men in the class. It is high time this Association took some decided stand in this matter. The colleges may require enough in the way of tests from the students when they go out, but their rules are not stringent enough with regard to the general education of students. I would require a written preliminary examination, and this is the only time when

it can be told whether students have the necessary qualifications. If some such requirement were insisted on, it would be a great step in advance.

Dr. Buckingham: There have been assertions made that we want to correct. One was, that dental faculties graduate students for the sake of getting their money. This is not so. In the first place, they have no inducement to do so. They do not lose anything by rejecting them, as the student pays his money when he enters, and it is not returned if he fails to pass the examination. I do not think there is a college that would make an agreement either to pass a student or return his money.

I believe the colleges are doing the best they can under the circumstances, and if you would give them your support they would do better. Colleges, like all other institutions, must have material support, or they will settle into a routine, and not advance. If more of the dentists would visit the colleges when they are in session, and learn more about their working, there would be less said against them at these meetings. I do not claim that the colleges are perfect, but do claim that they make better practitioners of dentistry than are made in private offices. Their curricula of study and their facilities for teaching are better than can be adopted by any private instructor. When a student enters college, he has the facilities to study anatomy, physiology, and pathology better than he can ever have anywhere else. He also has a systematic course in chemistry, operative and mechanical instruction, and when he graduates we certify that he is competent to practice dentistry. We do not say he is perfect, and has nothing more to learn. If the best student of any college were to close his books when he graduated, and stop studying, he would not be much of a scholar in a short time. Knowledge is only acquired and advanced by constant study. All that can be done in the college is to teach the student the principles of the profession, and let him put them in practice after he has graduated. We think dental colleges should teach all that is required in the ordinary practice of dentistry, and we are therefore in favor of having colleges of our own, and not medical colleges with dental departments. We know very well that the practice of medicine and the practice of dentistry overlap each other, but the general practice is very far apart. The physician depends upon his medicine stimulating and assisting nature to perform a cure, while the dentist expects his work to prevent further progress of the disease. As the prevention is different from the cure, so we think the teaching should differ. A student should

first learn that which is essential to his practice; then, if he has time and capacity, he can add to it. He should not lay in a large stock of information which he cannot use, and neglect more important material.

The science of medicine has been so extended that no one person can grasp it all, and if dentistry is added to it one or the other must suffer from the error. Let us compare the surgeon and medical doctor with the dentist, and see the difference in their requirements. They both should have a knowledge of anatomy; the one a minute knowledge of the whole system, and, if he is a well-informed doctor, he will have a general knowledge of the teeth and their diseases; while the dentist must know the teeth and the parts surrounding them, and only have a general knowledge of the remaining parts. As in the department of anatomy, so also in all the other branches of the medical science. Now, there is a very wide difference between a general or superficial knowledge of a part and that minute knowledge which will enable a practitioner to treat it properly. Again, a physician requires a full comprehension of all the medicines; the dentist only a very few, his treatments being nearly all mechanical. We might carry this comparison to an unlimited extent, but we have probably said enough. It was only intended to show that while they run partly in the same track, the requirements and practice are very different.

But dental departments in medical colleges do not require the student to take the whole course of medicine. The dental department of Harvard College is separate from the medical. The dental student attends some of the lectures with the medical students, but not all. His dental instruction is given separately. The same applies to the University of Pennsylvania. The dental student there attends but the first course of medical lectures, and as the course is a graduated one of three years, in which the instruction of each course is different, and as the dental student receives only the first course, he receives instruction from four medical professors, while the medical student receives his instructions from eleven. We speak of these two colleges because we know more about them than of the other medical colleges that have dental departments, but we believe that what has been said will apply to all. Now, is it not better to have in dental colleges teachers who are well acquainted with medical science, and have them select from the medical books the subjects that apply to dentistry, and condense and place them in proper form? In this way the whole science of medicine can be gone over without cramming the

student with matter which may be of great value to the medical practitioner, but is of little use to the dentist. Or, why do not those who claim dentistry to be a specialty of medicine require the student to take the whole course in medicine, as other specialists do? As it is now taught in medical schools, the dental student receives his instruction from three or four medical teachers, and the other seven or eight are not required. I want it distinctly understood that I do not object to dentists graduating in medicine, but do claim that a dentist may practice dentistry scientifically without such a degree.

VOLUNTEER PAPERS,

BELONGING TO NO SECTION.

VOLUNTEER ESSAY BY JOSEPH RODES BUCHANAN, OF NEW YORK.

On the Centric Relations of the Teeth, the Mouth, and the adjacent parts to the entire Constitution, through the medium of the Proximate Portions of the Brain.

IN this paper I propose to state certain physiological principles which were discovered nearly forty years ago. My chief discovery in 1841 was this, that in many persons the functions of the brain were so delicately sensitive that when the individual is passive there is an instantaneous sympathy between the exterior and interior of the cranium, so that the sensations in the scalp and membranes indicate exactly the condition of the subjacent portions of the brain, and every application to the exterior of the cranium may affect the brain, whether it be heat or cold, medical agents, galvanism, or the human nervaura, commonly called animal magnetism.

That a sufficient amount of this animal magnetism may produce in certain persons a state of somnambulism and trance, with insensibility to surgical operations, is an old and familiar story, as many teeth have been extracted and surgical operations performed in this state of insensibility in private practice and in hospital operations.

My discovery in 1841 was that the nervaura of the hands may be applied so as in sensitive persons to concentrate the energy of the brain in any part, and thus produce a manifestation of its functions, either mental or physiological,—such as love or hate, benevolence or combativeness, muscular strength, respiration, digestion, calorification, or refrigeration,—controlling the pulse, the muscles, the bowels, the lungs, and the physical sensibility, as well as the emotions and passions. At the same time I discovered the science of psychometry, by means of which much more minute investigations of the brain may be made.

These experiments on the brain, since my first announcement of the discovery, have been repeated throughout the greater part of the civilized world in a more or less scientific manner, and some of my discoveries of functions have been verified by Prof. Ferrier's experiments on animals.

In the prosecution of these experiments I have organized what the world never before had, a science of ANTHROPOLOGY, and this has opened up to science what was before a complete *terra incognita*, the anterior inferior region of the brain—the region lying behind the face, with which the dental profession is in continual relation.

Gall and Spurzheim, to whom we are indebted for the true anatomy of the brain, are the only scientists who have ever undertaken systematically to develop the functions of the cerebral convolutions. Their discoveries, though crude, were substantially correct, and have in the main been verified or corrected by my experiments. But they located organs only as they were accessible through the exterior surface of the cranium, and did not attempt to explore that basilar region which is covered by the neck and the face. Neither did they realize that the brain was the controlling center of physiological as well as mental life, and that *all physiological functions had controlling centers in the brain.* Hence their system was psychic or phrenological, and not physiological. The development of the character of the brain as a physiological organ was reserved for my peculiar experiments. And as the most important physiological functions of the brain lie in that region overlooked by Gall, which is covered by the face and neck, and as these functions are powerfully affected by the adjacent parts of the neck, face, and mouth, it is clear that a proper understanding of these functions and localities and the mode in which they are affected by diseases and operations must be of great importance, not only in dentistry but in the general practice of medicine; for every morbid condition, anywhere from the top of the forehead to the base of the neck, must affect powerfully the cerebral structures behind it, constituting the antero-basilar aspect of the brain.

There are two modes of studying this subject. First, the method I have adopted of developing by experiment all the functions of this antero-basilar region, and drawing therefrom the inevitable inferences as to how the adjacent structures may affect the brain, and how the brain may, in turn, affect the adjacent structures,—thus developing a new symptomatology of the mouth, teeth, face, and neck. As, for example, when the incisor teeth and gums in their irritations produce

a cough, or when pneumonia, reacting from the controlling organs in the brain, produces a peculiar red line on the gums.

To present this matter in a clear and practical way I should proceed, omitting all history of experiments and discoveries, to state the locations of the functions in the antero-basilar region, and the manner in which they may be affected by diseases and operations.

What is called the forehead, usually uncovered by hair, contains the organs of the purely intellectual powers. Hence, this is the region in which we feel a sense of tension, or aching, or heat, from overaction of the intellect in observation or study. This part, the front lobe of the brain, sympathizes with the bronchial region of the chest, and hence a tensive pain in the forehead is one of the symptoms of bronchitis. The front lobe has no physiological energy, but tends to expend the vital force. Hence, protracted mental labor is exhausting, and the continued working of the intellectual faculties would be fatal to life if not arrested by sleep.

The base of the front lobe—the convolutions resting on the supra-orbital plate and covering the entire socket of the eye—contains the organs of perception, which use the eye; in other words, the organs of vision. Hence the intimate sympathy between the eye and the brow or base of the forehead. The destruction of one eye causes an ultimate shrinkage of the perceptive convolutions of the opposite side, as in the case of Curry, of Alabama. Behind these perceptive or visual convolutions, running back along the base of the middle lobe, we come to the region of sensation or sensibility. This I discovered by external observation as far back as 1837–8, and in 1841 proved by experiments on the brain in the living. Recently Prof. Ferrier has completed the demonstration of this discovery by a cruel experiment on a monkey. By destroying with an iron rod this base of the middle lobe on the left side, he destroyed sensibility in the right half of the body; thus confirming what I had known and taught for a third of a century.

The anterior part of the region of sensibility near the visual organs contains the organ of hearing, which is tributary to music and language. Prof. Ferrier neglected to notice whether hearing was affected in his experiment on the monkey. As the region of sensibility lies along the zygomatic arch and malar bone, it follows that breadth of the head in this region indicates a sensitive temperament, easily affected by medicine or by pain, sensitive to magnetic influences, easily impressed by animal magnetism. When the head is hot in the temples there is great sensitiveness; the eyes are intolerant of

a strong light, the ear of loud sound, and the surface of pain or of any rude contact. If the heat is on one side the sensibility is developed on the opposite side, and limited by the median line. Those with this region large are intolerant of everything that gives pain, and unless they have large firmness cannot bear it. At the same time, they are sensitive to magnetism, and their pains may be relieved by dispersive manipulation with the hand. The existence of this heat in the temples produces a sensitive, excitable condition, which should forbid dental operations until it is relieved. This may sometimes be done by sponging off the temples with warm or hot water, or by rapid dispersive passes with the hands, chiefly in a backward direction.

We come next to the organs behind the face. These organs are reached and excited through the face, and in making a map of external development they are necessarily marked upon the face. The space which they occupy at the base of the brain is much less than the space marked externally on the face.

The functions controlling the alimentary canal commence at the base of the zygoma and articulation of the lower jaw, which locality controls the stomach by giving the sense of hunger, and is phrenologically expressed as the organ of alimentiveness (which was located too high on the old charts of phrenology). Gastric digestion does not depend *exclusively* on this organ, for it is reinforced by the portions of brain behind it. From that spot, extending under the middle lobe, along the petrous portion of the temporal bone, the functions control the entire intestinal tract, from stomach to rectum inclusive. Externally this is marked along the jaw to a point below and behind the angles of the mouth, corresponding with the lower anterior molar teeth.

This location of the alimentive functions in the brain may easily be verified if we observe that great breadth and fullness in this region just in front of the ears, with a florid appearance of the surface, is accompanied by active appetites. In the drunkard and glutton there is frequently a red and bloated fullness at this spot. Great narrowness across and hollowness just in front of the ears, with a pallid, shrivelled appearance, is connected with deficiency in the appetites and digestive powers.

These locations indicate that the digestive organs are brought through the brain into intimate sympathy with the molar teeth of the upper and lower jaws, and with the lateral posterior portion of the tongue. I would therefore invite you to observe the influence

of diseases of the molar teeth and of operations on these teeth upon the digestive organs, and also the influence of the digestive organs on the molars, for I desire to profit by your experience. Do you not find toothache responsive to gastric conditions, and do you not find molar disease exercising great power over the stomach and bowels, and do not all the teeth when much irritated affect the alimentary canal?

Dr. Condie, in speaking of cholera infantum, says that the process of dentition is unquestionably a predisposing cause of the disease, and therefore considers it necessary in this disease to examine the gums, and lance them if hot and swollen.

Dr. J. F. Duncan, attending a Dublin work-house in which there were sixty or eighty children under two years of age, described in the Dublin *Medical Journal* a severe ulceration of the mouth and gums of children very much like a mercurial ulceration, accompanied by diarrhœa, high fever, and enteritis, progressing rapidly to a fatal termination, which was controlled by such remedies as counter-irritation, acidulated decoction of bark, wine, columbo, and nitric acid. The remarkable fact in this case is the intimate and complete sympathy between the condition of the mouth and the abdominal disease. He could do no good at all by local treatment of the mouth, but counter-irritation of the abdomen worked like magic. A mustard plaster on the abdomen followed by a blister for an hour controlled the diarrhœa, controlled the fever, *and controlled the disease in the mouth.* Which proves that, while the mouth may set up disease in the abdomen, disease in the abdomen may be the sole cause of disease in the mouth. Hence, if a dentist is to take care of the teeth, he should understand enough of medical philosophy to discover a morbific cause in the abdomen when it exists, and treat the causes instead of the effects.

The last molar or wisdom-tooth, especially that of the lower jaw, occupies a position which gives it a remarkable power over the nervous system, beyond that of all the other teeth.

All the teeth, especially of the lower jaw, share in this power over the nervous system, but it attains its maximum in the wisdom-tooth. The cause of this is that it approximates that region of the brain in which the insane tendency resides. The insane diathesis or tendency is the result of an extreme degree of excitability in the mental faculties and organs, which renders them unable to maintain their equilibrium under disturbing influences. This excitability depends upon the most sensitive region of the brain, which

attains its maximum at the entrance of the carotid artery. It is not far from the region of physical sensibility.

Externally we find the carotid artery and jugular vein, and along the carotid artery the superior cervical ganglion and carotid plexus, which with their prolongations control the circulation of the anterior part of the brain, and may either cause a hyperæmia in any of the intellectual organs, or by a spasmodic action may shut off their circulation and paralyze their functions. Mania in the anterior part of the brain depends on the circulation from the carotid artery, as in the posterior part it depends on the vertebral artery.

This external arrangement corresponds with the location of the internal function which I have demonstrated in the brain, which in its normal action gives cerebral excitability, and in its abnormal excess produces a liability to insanity, as the region of the brain a little farther back produces in its excess a tendency to rage and to murder, which are half-crazy impulses.

From the location of the wisdom-teeth they are thus enabled to exert a greater power over the cerebral circulation and excitability, —a depressing and deranging influence,—which may be manifested in a thousand different ways, especially in melancholy gloom, disqualifying for study and for the enjoyment of life, unfitting for business, and producing mental confusion and hallucination, ill-temper, restlessness, and unpleasant dreams, and in extreme cases mania and even paralysis. One of the most eminent dentists of this country, a member of your body, interested me by the description of a species of hallucination or optic illusion which he experienced during the cutting of a wisdom-tooth. Dr. Samuel Sexton, who has given much attention to these subjects, reports that in some cases progressive dementia has been arrested by the repair of a tooth, which was the real cause of the trouble, though apparently making no disturbance itself.

Of course, I do not say that this influence on the brain and nervous system is strictly confined to the wisdom-teeth, although more perfectly developed in them. The molar teeth all participate in this influence, and a similar influence is exerted by the parts of the neck and throat lying between them.

Dr. Fleiss, in a German medical journal ("*Journal für Kinderkrankheiten*"), refers to these paralytic attacks from dental causes, which he says had frequently been erroneously ascribed to rheumatism or to contusions. They arise, he says, in the *second dentition*—scarcely ever in the first, which is more inclined to convulsions—the second dentition being more inclined to paralysis and neuralgia. In the

cases of paralysis recorded by authors, Dr. Fleiss finds that the *molars* have generally been mentioned as being in progress of escape from the gums. The attacks come on rather suddenly, preceded by some heat in the head and feverishness. Usually an arm is affected; sometimes an arm and a leg, or even both legs; sometimes both arms. It may last a few weeks or months, or may become incurable and produce an atrophied arm. The paralyzed limbs are disposed to be convulsed under mental irritation. (I would remark that this statement of Dr. Fleiss shows that the brain is in a somewhat exsanguine condition, which is the natural consequence of irritation at the base of the middle lobe.)

Sometimes the paralysis is obstinate, and symptoms of cerebral and spinal affection, dyspnœa, palpitation, coma, and death occur. In a case of paralysis of the left arm, in a boy of five years, "the anterior milk molars were found lying half decayed in the gums," and near and between them were the edges of the permanent molars in a row in the gums. Being accidentally killed, it was found that the spinal cord on the left side at the roots of the brachial nerves was congested, and that a turgescence of the veins extended along the shoulder and neck to the face on the left side, being especially marked in the submaxillary region.

In this case I would say that the transmission of the paralysis was by direct nervous and vascular connection, favored by the paralytic tendency of the brain. But when the deranging effects are produced by the centric influence on the brain, they are more general and are more apt to be developed in the brain itself, and in the lower rather than the upper part of the body, since the basilar region of the brain has a more intimate relation to the lower part of the body.

The paralysis from superficial connections, instead of centric influence, illustrated by Dr. Fleiss, may also be illustrated by the numerous examples of diseases of the eye and ear caused by defective teeth transmitting their irritations through the tri-facial and facial nerves. Even myopia has been sometimes attributed to this cause. But this is foreign to my subject—the *centric relations* of the mouth. The relation of the anterior teeth to the thoracic region was very forcibly shown by Prof. Bolling, of Nashville, formerly of Alabama; and the same truth was abundantly illustrated by a German physician, Dr. Fredericq. I regard their essays as the most valuable statements that have ever been published to illustrate the philosophy of pneumonia by its dental symptoms. They simply stated the facts, without knowing anything of the

bearing of these facts on cerebral physiology. They had no idea of my teaching for many years that the respiratory functions were so located in the brain, just above the medulla oblongata, as to correspond to the lower anterior part of the face, and to maintain as close a sympathy with it as the forehead does with the anterior part of the front lobe.

Dr. Bolling says: "I have frequently observed in pneumonia a symptom of which I do not remember to have seen mention made by any other, and which I have never noticed in any other disease. It consists in a deposition on the teeth just along the margin of the gums of a matter of different shades of color, from a light orange to a dull vermilion, forming a line about a sixteenth of an inch wide, and of a deeper tint at the gums, and paler as it recedes. Unlike the blue line said to be found on the margins of the gums in lead-poisoning, and the line on the same part of a deeper shade than the rest of the gum noticed by Dr. Theophilus Thompson in phthisis, and mentioned in the London *Lancet* for September, 1857, the appearance in question is noted on the teeth, from which, indeed, with care, it may be principally removed by wiping; though, occasionally, a somewhat durable stain remains upon the enamel. In regard to the manner of its production, I am at a loss for an explanation, though it is probably an exudation from the margin of the gums. At first I thought it might be produced by the deposition of the coloring matter of the expectorations; but I have seen it in cases in which bloody matter was not expectorated—indeed, in a few cases of latent pneumonia, where there was neither cough nor expectoration; and in one instance I was led to suspect the presence of this form of the disease (which I ascertained with certainty by auscultation) by this symptom alone.

"Perhaps the miasmatic poisoning of the system may in some way lead to its development in pneumonia; for it is likely that if it were of as frequent occurrence in other localities as this, it would have been noticed before. Still I do not remember to have seen it in any of the forms of uncomplicated miasmatic fever. I have made no note of the proportion of cases in which I have observed it, but I think at least in one-third or one-fourth. The cases in which it is present are generally severe, it being very rarely found in mild cases."

If severe pneumonia produces the appearances described by Dr. Bolling, it would seem probable that other pulmonary diseases would also show themselves by the teeth and gums. In the seventh

volume of the French *Medico-Chirurgical Review* is contained this statement of Dr. Fredericq's observations:

"M. Fredericq published some observations in 1847, in which he stated that *in phthisis a red streak* is constantly to be found on the gums opposite the lower incisors, and sometimes the upper ones also. Since this he has paid great attention to the subject, and now says that in the latter period of all chronic diseases, some time before death, a blue or red streak will always be found; but that in phthisis it is one of the earliest signs. In all the cases of phthisis, without exception, that have come under his notice, he has met with this brick-red or blue streak. The *brick-red* color is especially found in inflammatory phthisis, or at least when much bronchial irritation and nocturnal fever are present; while the *blue* color denotes a less active form of disease, and is oftenest found on those who suffer from abundant pneumorrhagia, although by no means always indicating the probability of the occurrence of this. In a few cases, a *white* line, as observed by M. Vanoye, contrasts with the general color of the mucous membrane, and those who exhibit it are usually of a marked scrofulous and cachectic habit.

"These streaks are of great importance in announcing early phthisis in those cases in which doubt prevails as to whether bronchitis or catarrh is connected with tubercle. The author has never known persons suffering from bronchitis in whom this mark was absent afterward become the subject of phthisis; while those in whom it was distinctly present have all afterward furnished signs of tubercle. The deeper the color the more rapidly does the disease proceed, while it is a good sign to find it becoming paler.

"Patients in whom the process of softening has become temporarily arrested, and who believe themselves cured, continue to offer the blue mark, but paler than before; but when the disease recommences its march the mark becomes plainer.

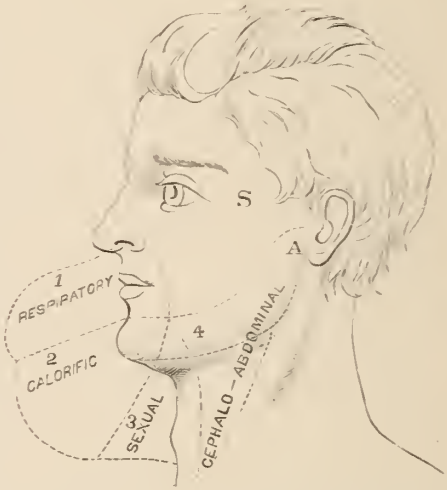
"In chronic abdominal affections there is a dirty, livid-looking streak along the whole extent of the gums, and much broader than in phthisis.

"The following are the author's conclusions: 1. The red, blue, or white streak along the incisor gums is only of real semeiological importance when manifested early, since it is always seen in the latter period of chronic disease. 2. It is observable as soon as the cough occurs in phthisis. 3. In aged persons, where there is retraction of the gums, it is not present. 4. Where the brick-red streak exists it is a sure indication of tubercle; the blue one, which

is common in other diseases, is also frequently so. 5. Chronic abdominal affections give rise to a livid streak along the entire gums."

Influenza being a lighter affection, located higher, would, according to these principles, manifest its physiognomic sign higher or more anteriorly. Accordingly, we find that in an epidemic of influenza at Sacramento City, described by Dr. G. G. Tyrrell, "herpes labialis was a constant symptom."

The dentition of every infant is an illustration of these principles. As the dentition begins in the incisors and extends on each side, a high degree of irritability is developed by sympathy through the brain in the lungs—a sympathy proved by the observations of Bolling and Fredericq—which renders them liable to every disturbance, and sometimes develops into bronchitis, or at least into a cough. This irritability, also, sometimes develops *laryngismus stridulus*. A feverish or heated condition, and a consequent tendency to eruptions of the skin, is a regular attendant, and arises from the impression of the anterior dental region on the medulla oblongata, the great source of bodily heat and cutaneous conditions.



As a guide to observations on this subject, I would suggest the division of the lower facial region into four sections. 1. The respiratory, extending from the ala of the nose to the roots of the lower incisors. 2. The calorific region, embracing the chin. 3. The sexual region, extending from the molar and bicuspid junction down the neck. 4. The abdominal and cerebral region, lying near the posterior angle of the jaw. I do not present this as a complete and accurate statement, but merely as a help to observations.

The sexual region in its upper part is an external development in the direction of the parotid gland, which has so intimate a sexual relation that its inflammations are very liable to sudden metastasis, either to the testes or to the mammæ. The influence of the parotid

gland in parotitis or mumps is also analogous to that of the molar region; it produces headache, loss of appetite, and sometimes great heaviness. The influence of this region on the brain is enfeebling and deranging, but not so exciting as the more anterior regions, nor so oppressive and injurious as the posterior region. I think the further progress of pathology will in time establish that the sexual functions are connected not only with the superior central region of the cerebellum, which I consider established by pathology, but with its anterior inferior region and the cervical region of the spinal cord—a suggestion which I believe is entirely novel, and which I publish now by way of a *caveat*.

The influences of the third and fourth regions on the brain are combined in the larynx and throat. The comatose and paralytic tendency of diseases located there is very well known, and if this paper had not been prepared in great haste, for want of time, I might have arranged a very striking and illustrative group of pathological symptoms belonging to these regions, showing that they have an influence on the brain which comes from no other locality, because no other locality is in so close connection with the central basilar region of the brain. The functions of this central basilar region I have known by experiment and taught for a third of a century, but they are not known to physiologists, because they have not known the best methods of investigation. Whenever they come to the border line of the material and the psychic, they are utterly lost. Like the hen that has raised a brood of young ducks and sees them swimming out on a lake, deeply alarmed and disgusted in the belief that they are going to perdition, so does old physic look on young physic exploring new realms in science.

We see the influence of this central basilar locality on the brain in scarlatina, croup, diphtheria, cynanche tonsillaris, laryngitis, tracheitis, and bronchocele.

"In laryngitis," says Dr. Bell, "where the inflammation is intense, the innervation may be so profoundly disturbed as to mask the evidences of the local disease." That is to say, the effect on the brain is greater than the local effect of the inflammation. The patient is drowsy, disinclined to speak, but if questioned says that he feels no local pain.

In acute œdematous laryngitis, running to a fatal end in from one to five days, the patient becomes enfeebled, delirious, drowsy, and at last comatose.

In the membranous laryngitis or croup, which extends into the

trachea, and even affects the bronchial region, the downward extension justifies us in inferring, according to cerebral physiology as I have discovered and taught it, a more excitable and wakeful, restless condition than when the disease is confined to the glottis.

"It is often indicated," says Prof. Bell, "by variable spirits, greater readiness than usual to laugh or cry. The patient exhibits great anxiety and restlessness, and a frequent desire to change from place to place." This condition is one of wakefulness, while a higher location produces the drowsy or comatose tendency, all of which is explained by a true cerebral physiology. Under this downward extension of the disease, according to Bell, the patient "tosses about in great distress," grasping the objects around him convulsively, and exhibits great exhaustion of the vital energies, terminating in lethargy and death.

All severe diseases of this neck region exhaust the physiological power of the brain and exhibit a comatose tendency, showing that they kill by nervous prostration.

Dr. Cotting, of Roxbury, reported an interesting case of a female in which a membrane was developed, extending down the trachea into the bronchial ramifications. The result is easily deducible from the principles of true cerebral physiology. The bronchial region in the body, according to the science of sarcognomy, corresponds with and maintains the closest sympathy with the front lobe or intellectual region. Hence excitement in that region gives great mental activity and consequent wakefulness; it also produces great exhaustion of vital force, as we see results from the front lobe in prolonged study or wakefulness, which prevents the intellect from resting. This tracheal and bronchial condition therefore necessarily produced sleeplessness and exhaustion. She continued sleepless and restless, constantly changing position, for about six days and five nights, and then ejected the lining membrane by great effort, and rested or slept for about half an hour, and being now relieved should, according to medical ideas, have speedily recovered; but, in fact, in a few hours she quietly ceased to breathe from mere exhaustion.

There is no medical explanation for the rapid death caused by inflammations of the larynx and trachea; life is rapidly exhausted by a disease which exhausts the base of the brain, and the sufferer is conscious that his life is passing away. George Washington lost his life from this disease in twenty-four hours, and from the first he felt that it would be fatal. Ten times the amount of disease at the superior anterior region of the brain would produce no danger,

for it is not a vital situation; and fifty times the amount of disease in the lower limbs could be safely borne.

The trachea is not simply a mechanical channel for the air; it is a sensitive tract in the most intimate sympathy with the medulla oblongata and cervical portion of the cord. Hence it is one of the nearest approaches to the citadel of life; and sudden death has sometimes occurred during tracheotomy or from fracture of the larynx, which medical science does not explain. The sudden occlusion of the trachea by a ligature is as fatal as a division of the spinal cord in the neck; indeed, more so, for it instantly arrests respiration and circulation also. So it seems that life depends directly on the trachea, through its relations to the medulla.

I have stated that the region of the lower jaw and neck, *by its relation to the brain*, affects the lumbar, pelvic, and crural regions, although it may sometimes, by direct nervous connection with the brachial region of the cord, affect the arms. This is well illustrated in *laryngismus stridulus*, or spasmodic croup, in which the hands are generally clenched, the feet turned inward and downward, the backs of the hands and feet often swelled. "In a few cases the buttocks or groins become tender and exude watery lymph; and in perhaps every case of the disease, the buttocks, even when well covered, are as cool as if newly washed." Frequently the child is unable to stand or walk erect, and convulsions are a frequent accompaniment. This effect on the buttocks is also noticed in ordinary dentition. Blotches or papular erythema often appear on the buttocks, thighs, hips, and the lower jaw, which correspond to their controlling region in the brain.

No physiologist has ever reached or pretended to reach the causes of these peculiar associations of symptoms, which a true cerebral physiology explains with ease; and I may say that a large mass of the mental and physical symptomatology of disease, and groups of sympathetic symptoms, presents but a tangled wilderness, in which science has opened no road; and whatever we know has only been learned empirically and retained by memory without the help of reason.

Chronic laryngitis may arise from irritations of the mouth or caries of the teeth, and a celebrated Italian singer lost her voice in that way. But I have no time to adduce illustrations.

All irritations of the teeth and gums affect the antero-basilar regions of the brain, which tend to lower the moral energy and disqualify the individual for society, producing excitability, temper,

resentment, peevishness, and a depressed state of health and spirits. It is impossible to maintain high health with any irritations or morbid influences in the mouth; hence a clean, healthy mouth is one of the most indispensable conditions of health. Diseased teeth or unwholesome dental applications in the mouth have so prostrating an effect that sometimes life is hardly worth living until they are removed; and when they are removed there is a rapid and almost magical improvement in health. It is a great mistake to suppose that noxious substances in the mouth are harmless if they are not soluble enough to be absorbed. My experiments have been showing for forty years that every substance in contact with the human body produces its own specific influence from the external surface just as it would from the internal surfaces. A sensitive individual can hold different metals in the hands, or different medicines contained in envelopes, and incapable of absorption, and distinguish them and state their influences as well as if they had been swallowed. All who have attended my college lectures are familiar with this fact; hence, when anything is inserted in the mouth, it should be a substance which is in itself wholesome, and not poisonous or depressing. Of late years Dr. Charcot, of Paris, has been making some experiments on this subject, and his metallo-therapy is a reproduction of what I discovered in 1841. (The Kentucky State Medical Society appointed a committee to investigate my experiments in 1877, but they were so indolent or preoccupied that no action occurred during the subsequent months that I remained in the State.) While these general remarks are applicable to all the teeth, there is a marked difference between the anterior and posterior teeth. The molar teeth have a greater influence on the abdominal organs and brain, while the incisors, canines, and bicuspids exert their influence chiefly on the respiratory and calorific functions. In other words, dental irritation has a greater effect on the bowels as it advances further back in the jaw from the front. The incisors and canines have the strongest effect on the respiratory organs, and the lower incisors are the most exciting and most liable to develop a cough. The lower incisors and canines are also more heating and feverish in their tendency, from their more direct influence on the medulla oblongata.

Any extensive observer of nature might verify this close connection of the respiratory and calorific functions with the anterior part of the mouth, which covers the cerebral organs of respiration and calorification. My own experiments demonstrate that these organs

are located in the brain, behind the mouth; and the important experiments of Chossat on animals, which have not been appreciated by physiologists generally, but which I consider the most valuable and satisfactory ever performed in vivisection, clearly traced up the calorific power to the medulla oblongata, and traced its operation from that controlling center through the spinal and ganglionic systems in a manner which fully corroborates my own experiments.

To the development of the medulla oblongata the chin externally corresponds—not, of course, with the precision of necessity, but with sufficient uniformity to become an important external sign. The chin is well developed in races that have calorific power well developed, and the tendency of such races is toward fever. The chin is deficient in the African race, and the negro has little ability to resist cold, and very little tendency to fever; almost entire exemption from yellow fever. The negro suffers in cold climates, the white man in the tropics. The infant has nearly the negro physiognomy, and has less ability to resist cold than the adult.

The respiratory organs are always well developed and strong when the lower part of the face around the mouth is prominent.

As respiration and calorification need protection in cold weather, nature has placed over their organs in man a protective beard, and many persons wear their beards simply because they find them a protection against colds. Some are liable to catch cold from shaving around the mouth, unless they cover it with a handkerchief; and experience shows that a small woollen protection or muffler around the mouth, chin, and back of the neck gives more protection against cold, by protecting the vital organs of the brain, than ten times the amount of clothing on other parts of the body. Of course, dental operations on the front teeth should be conducted in view of these principles, watching the sympathy of the lungs and the anterior teeth.

The teeth of the lower jaw, anterior to the molars, have a decided influence on the pelvic and reproductive organs, and should therefore be critically observed in connection with hysteria, and all derangements, disorders, and excitements of the sexual organs.

This influence, however, extends to the lower incisors also, and it should be remembered that none of these sympathies are rigidly confined to these localities. The affection in the mouth corresponding to or caused by any corporal disease tends to extend through the mouth, and the effect of dental conditions on the body is not confined to their sympathetic locality.

If you would test these principles by observation, I would suggest that you observe and record the dental conditions in all very protracted menstrual derangements, uterine disease, and pregnancy. Drs. A. and M. D. Pinard have already made such observations on pregnant women, and in an essay in the *Bulletin Générale de Thérapeutique* they describe the gingivitis, or affection of the gums in pregnant women. In the examination of seventy-five women they have found forty-five with diseased gums—a condition which they did not find among the non-pregnant. The gums were red, congested, and swollen. "The edge of the free border, especially the interdental membrane, covered a part of each tooth. The slightest pressure on this edge caused a slight hemorrhage. At a more advanced stage the teeth lost their solidity. The mastication, at first injured, became more painful and more difficult as the lesions were more pronounced. The condition was more frequent in the multiparæ than in the primiparæ. It was sometimes in women *of good health and strength*, but generally in those who were much impaired. Treatment by a solution of equal parts of hydrate of chloral and scurvy grass [cochlearia] applied to the gums generally effected cures in about fifteen days."

As I have had little opportunity of making observations on these practical applications of cerebral physiology, I hope that I may learn from your experience what importance to attach to them in the treatment of disease. That the lower jaw holds intimate relations to mania and nervous diseases, and that the anterior portion of it has relations to the sexual as well as to the respiratory organs, gives us an important field of observation.

That the teeth and gums have just such relations as I discovered forty years ago has not entirely escaped the observation of practitioners of medicine; such facts have been developed millions of times under the eyes of physicians, but how few are there who observe and report facts which would be beneficial to science!

I hope to receive from the dental profession many important facts bearing on these physiological principles, and I would call attention to the great importance of the lower jaw in its relation to the brain and nervous system, to the sexual apparatus, to the respiratory and calorific functions, and also to the muscular energies springing from the cerebellum, which are in correlation with the lower part of the face, while the upper jaw holds relations to the anterior part of the middle lobe, which is less important to life, and therefore is less critical in its relations to health than the lower jaw; for this part of the

middle lobe may be injured or even shot away without any dangerous consequences.

That the anterior part of the middle lobe, and consequently the upper jaw, are of less critical importance, was shown very remarkably in two cases—one the case of Phineas P. Gage, who, at Cavendish, Vermont, in September, 1848, was shot through the anterior part of the middle lobe by a tamping-iron, which passed up through the brain, and who had a remarkably rapid and complete recovery. The other case was that of Mrs. Crave, of this city, who (January 26, 1881) was shot in the middle lobe on the left side through the temporal bone, and who even seemed to improve in health and appetite after the wound, but died from an abscess in another part of the body a few days ago. The principle thus illustrated, that the the anterior structures are less important to life, having less physiological power, is in accordance with all surgical experience as to wounds and injuries of the head, the importance or danger of which increases regularly as we pass backward from the base of the front lobe over the top of the head, the maximum danger being at the base of the occiput. The same principle applies on the lower as well as the upper surface, and the cerebral relations of the upper jaw being more anterior than those of the lower jaw accounts for its minor importance. What we thus learn by surgical experience we can learn just as positively and more clearly from the physiology of the brain given in my system of anthropology.

The relation to the sexual apparatus which begins about the junction of the molars and bicuspids extends under the jaw down the neck to the sternum. I regard this as dependent on relations to the spinal cord and cerebellum, which I need not discuss at present. Every one is familiar with the influence of the sexual functions on the development of the larynx and voice at puberty, and the close sympathy that exists through life, but I am not aware that any one has traced this sympathy in the opposite direction to show the influence of diseases in the larynx and trachea over the sexual functions in causing their impairment, to which I would call your attention and ask your observation. That this sympathy extends down to the base of the neck and causes its swelling or development by erotic excitement or puberty has not escaped notice. One of the old Latin poets (I do not recollect his name; perhaps it was Ovid) speaks of the voluptuous maiden whose neck in the morning cannot be embraced by the same collar that was worn the night before. This development of puberty has lately been made a test in recruiting

for the army among the mountaineers of Montenegro. No recruits under eighteen are accepted, and if there is no record of age it is determined by the rule of the string; that is, the length of the face down to the neck is measured with a string, and if the measurement around the neck is larger than this he is accepted as being over eighteen. Animal force you will find associated with the back of the neck (the bull-neck development), and sexual influence with the front.

The sexual locality on the lower jaw, corresponding with the anterior molar, corresponds also with the parotid gland, which is in a line between this locality and the cerebellum; and we know the parotid gland sympathizes with the testes and mammæ. As the throat is a still more posterior location than the trachea, it follows that its influence on the brain is of a still more vital character, as we see in sore throat and diphtheria; and as the mouth in general covers the entire antero-basilar region, its influence is more complete and varied than that of the teeth. Hence we find the entire constitution responding to the mouth. In aphthous stomatitis or thrush we find in association with it not only diseases of the alimentary canal, disordered digestion, gastritis, gastro-enteritis, cholera-infantum, dysentery, and typhus fever, but also diseases of the lungs, especially pulmonary phthisis in its advanced stages. When the aphthous eruption becomes confluent, there are fever, headache, vomiting, and other gastric disorders and derangements of the bowels.

The gangrenous stomatitis or gangrene of the mouth is a very clear illustration of the principles which I have stated. The ulceration in this case begins at the margin of the teeth and gums in front, generally at the incisors, and perhaps most frequently the lower, and extends into the lips and cheeks. Hence it is very feverish, and *its chief complication is pneumonia.* Bolling and Fredericq showed that pneumonia affected the gums and necks of the anterior teeth, and this disease shows that causation may run the other way—that a disease commencing at the anterior gums and roots of teeth may produce pneumonia. At any rate authors, especially the French authors, make pneumonia its chief concomitant; and frequently there is gangrene of the lung to correspond to this gangrene of the mouth.

The intestinal canal is also frequently attacked with acute enterocolitis or with softening, and a diarrhœa regularly comes on at the close.

But the causation may be in the other direction; the stomatitis may be the effect instead of the cause of the other diseases, as Dr. Hall, of Edinburgh, says he found this stomatitis a *consequence* of fever, acute disorders of the digestive organs, inflammation of the lungs,

variola, rubeola, scarlatina, or typhus. It all proves the same thing. The disorders at the mouth strike the vital organs of the brain and produce these diseases, or these diseases arise, and through the basilar organs they affect the mouth.

It occurs between two and ten years of age. It is more severe when it occurs at a later period and in the lower jaw, and the mildest form is when it occurs early *in the upper jaw.*

In *tonsillitis* we have headache, flushed face, feverishness, thirst, nausea, constipation, and high-colored, scalding urine.

Diphtheria, striking further back and down, has also intimate relation to the stomach, yet the appetite is sometimes good. It is nearer to the stomach than the teeth are in a mechanical sense, but according to the centric relation to the brain it is not; its relation is more like that of the posterior molars. It affects the brain with delirium or with paralytic exhaustion. Huxham speaks of his cases dying from a frenzy or disturbance of the brain. It is in almost the same line of centric relation as the anterior teeth to the respiratory and calorific organs, and hence the patients are often carried off by broncho-pneumonia and fever. Its great fatality corresponds to its posterior location. It is nearer the citadel of life, and if the vital force be weak, there is overwhelming prostration; if vitality be strong, there is great reaction and very high fever. It is from the first a dangerous invasion. The nervous system, says Bell, is depressed or stunned, requires no sedatives, and has not strength to bear much stimulus.

For the same reason, gangrene of the pharynx is one of the most fatal diseases. Time forbids me to go further in these illustrations, but I must mention one more, an illustration of the sexual region. Hysteria manifests a decisive symptom in the epiglottis. Dr. Chairon, of Paris, after examining twenty-six thousand cases, speaks of a peculiar insensibility of the epiglottis as the uniform symptom of hysteria. Others, however, say that there is sometimes hyperesthesia instead of insensibility. Syphilis makes its mark uniformly on the throat. Extensive practitioners in throat diseases say that pelvic diseases in women cannot continue long without affecting the throat, and that throat diseases cannot continue long without affecting the pelvic organs.

There are certain principles of common sense and common observation which tend to lead us into this understanding of pathology.

The basis of the brain is the seat of the vital forces. The convoluted structures have psychic functions, and may be very extensively diseased or destroyed without any serious injury to life. When

the corresponding part is removed from the brain of a hen, leaving the basilar structure, it remains a perfect animal but without an idea; all its functions are perfect, but it does not make a voluntary motion because it has neither ideas nor will. It is as if asleep, but it lives and grows and may even be fattened if we put food in its mouth.

The basilar part maintains its connection with the body through the neck, consequently a large neck indicating great basilar development signifies great animal force.

But the basilar region covers the face as well as the neck, and hence facial development indicates basilar development of the anterior parts. The law of physiology is that the anterior parts of the brain are more intelligent, sensitive, and excitable, and have less vital force; the posterior are more vigorous and necessary to life.

We all act on these principles in our judgment of men, without knowing why. In prominent, well-defined features we discover intelligence, but in the lower part of the face we see animal force. If a small face looks out from a window we are sure there is a small body attached, but if a massive face with lower jaw broad and deep appears we are sure there is a very substantial body behind it. We expect to hear a strong voice from it, and if that voice utters a threat we feel that there is danger, for there is bull-dog power to enforce the threat.

The force of animal life diminishes from the base at which life begins in the summit of the spinal chord to its most remote structure in the intellectual apparatus, which, instead of being a benefit or reinforcement to life, is a tax upon vitality to such an extent that if we did not every twenty-four hours arrest its action by sleep it would exhaust and destroy life.

We may therefore illustrate this conception crudely by delineating concentric zones of greater or less vitality from the basic origin of life to its spiritual consummation in the higher intellect, where human wisdom reaches up to the Divine, and would delight to leave the body behind and reach out to the mysteries of the universe, if it were not recalled by the animal nature which demands the bread-and-butter basis of life, and enforces this demand not by the muscles of the lips, but by the masseter muscles of the jaws and molar teeth.

In the mouth, jaws, and teeth, according to the doctrines of this paper, the dental profession stands as sentinel and janitor at the door of the citadel of life, and should, therefore, understand well each passage and winding-way that reaches the interior processes of life according to the definite and exact laws of the nervous system, some of which I have endeavored to delineate.

TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

TWENTY-SECOND ANNUAL SESSION,

HELD AT CINCINNATI.

COMMENCING ON THE 1ST OF AUGUST, 1882.

PUBLICATION COMMITTEE:

GEO. H. CUSHING, A. W. HARLAN, E. T. DARBY.

PHILADELPHIA:
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President,	W. W. ALLPORT	Chicago.
Secretary,	J. TAFT	Cincinnati.

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[Annual meetings to be hereafter last Tuesday in July.]

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[NO MEETING IN 1861.]

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* Owing to a change in the Constitution, officers elected at this and the sessions following served at the next annual meeting subsequent to their election and the sessions of and after 1869 commenced on the first Tuesday in August.

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W. C. BARRETT, Buffalo; C. R. BUTLER, Cleveland; G. L. FIELD, Detroit.

* These go out August, 1883.

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1882.

BY GEO. H. CUSHING, SECRETARY.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its twenty-second Annual Session at Highland Hall, Cincinnati, Tuesday, August 1, 1882, at 11.30 A.M., the President, H. A. Smith, in the Chair.

The session was opened with prayer by Dr. W. H. Morgan.

The roll of qualified members was then called, and the following were found either to be present or to have forwarded their dues:

ALLPORT, W. W.	240 Wabash ave., Chicago, Ill.
ATKINSON, W. H.	41 East Ninth st., New York.
d ARTHUR, H. W.	191 Penn ave., Pittsburg, Pa.
BETTY, E. G.	126 West Ninth st., Cincinnati, O.
BAUER, JOSEPH	130 Esplanade st., New Orleans, La.
BOGER, J. H.	Findlay, Ohio.
BROWN, SEN. B.	Fort Wayne, Ind.
BROWN, IRA	Cleveland, Ohio.
BARRETT, W. C.	11 West Chippewa st., Buffalo, N. Y.
BUCKINGHAM, T. L.	1228 Arch st., Philadelphia, Pa.
* BRACKETT, C. A.	Newport, R. I.
BUTLER, C. R.	519 Euclid ave., Cleveland, Ohio.
* BROCKWAY, A. H.	13 Greene ave., Brooklyn, N. Y.
BROPHY, T. W.	State and Madison sts., Chicago, Ill.
CROUSE, J. N.	2101 Michigan ave., Chicago, Ill.
CUSHING, GEORGE H.	34 Monroe st., Chicago, Ill.

Those marked [*] were absent but sent their dues.
Those marked thus [*d*] were Delegates.

* Coolidge, J. B.	Boston, Mass.
Cleland, James	Detroit, Mich.
Cowie, Henry	Detroit, Mich.
Callahan, J. R.	Hillsboro, Ohio.
d Cormany, J. W.	Mt. Carroll, Ill.
* Chaim, M. L.	30 Cooper Institute, New York.
* Colton, A.	Hudson, N. Y.
d Cravens, J. E.	Indianapolis, Ind.
d Canine, C. E.	Fifth st., Louisville, Ky.
Clayton, John R.	Shelbyville, Ind.
d Cameron, W. H.	Cincinnati, Ohio.
Clancey, D. W.	Cincinnati, Ohio.
* Colgrove, W. H.	41 Market st., Johnstown, N. Y.
Dudley, A. M.	223 Essex st., Salem, Mass.
Darby, E. T.	1513 Walnut st., Philadelphia, Pa.
Davis, K. B.	Springfield, Ill.
Dorrance, W. H.	Ann Arbor, Mich.
Dunn, Charles E.	Second st., Louisville, Ky.
* Davenport, S. E.	127 West Thirty-fourth st., New York
Evans, W. W.	1756 M st., Washington, D. C.
d Eames, W. H.	2930 Washington ave., St. Louis, Mo.
Emminger, A. F.	18 East Broad st., Columbus, O.
Field, George L.	Detroit, Mich.
Friedrichs, Geo. J.	155 St. Charles st., New Orleans, La.
Fundenburg, W. H.	323 Penn ave., Pittsburg, Pa.
Finley, M. F.	Washington, D. C.
French, Gale	Pittsburg, Pa.
d Fuller, A. H.	2626 Washington ave., St. Louis, Mo.
* Farrar, J. N.	15 Greene ave., Brooklyn, N. Y.
d Freeman, R. R.	Nashville, Tenn.
Freeman, A. W.	126 State st., Chicago, Ill.
Goddard, Wm. H.	Louisville, Ky.
Garber, S. A.	Tipton, Iowa.
d Garnett, W. M.	Glasgow, Ky.
* Gaylord, E. S.	152 Chapel st., New Haven, Conn.
Hunt, P. G. C.	Indianapolis, Ind.
Hurtt, J. M.	Peoria, Ill.
Harlan, A. W.	70 Dearborn st., Chicago.
Harroun, C. H.	Toledo, Ohio.
* Hill, J. L.	Gettysburg, Pa.
How, W. S.	Cincinnati, Ohio.
d Horton, W. P.	Cleveland, Ohio.
Harper, J. G.	St. Louis, Mo.
Hunter, F. A.	123 West Seventh st., Cincinnati, Ohio.
Heise, O. N.	Cincinnati, Ohio.
Hooper, J.	Louisville, Ky.
Hunter, E.	Jackson, Mich.
Ingersoll, L. C.	Keokuk, Iowa.

d James, C. H.	Cincinnati, Ohio.
Kempton, W. D.	Cor. Liberty and Freeman sts., Cincin., O.
* Knowles, S. E.	San Francisco, Cal.
Keely, Geo. W.	Oxford, Ohio.
Keely, C. I.	Oxford, Ohio.
Kulp, W. O.	Davenport, Iowa.
Keith, H. H.	615 Olive st., St. Louis, Mo.
Klump, G. W.	Williamsport, Pa.
Lathrop, Joseph	152 Woodward ave., Detroit, Mich.
d Leiter, T. C.	Wadsworth, Medina Co., Ohio.
* Moore, T. T.	Columbia, S. C.
McKellops, H. J.	2630 Washington ave., St. Louis, Mo.
Morrison, W. N.	1337 Washington ave., St. Louis, Mo.
Morgan, W. H.	Nashville, Tenn.
Márcklein, B. G.	Room 2, Iron Block, Milwaukee, Wis.
* McManus, James	Hartford, Conn.
Moore, E. C.	22 Lafayette ave., Detroit, Mich.
d Morgan, R. C.	Lancaster, Ky.
Morgan, Henry W.	Nashville, Tenn.
d Morrison, John B.	Indianapolis, Ind.
Meriam, H. C.	259 Essex st., Boston, Mass.
Noel, L. G.	238½ Church st., Nashville, Tenn.
d Nevins, G. F.	South Bend, Ind.
Odell, F. M.	7 West Thirty-eighth st., New York.
Peirce, C. N.	1415 Walnut st., Philadelphia, Pa.
Pollock, D. J.	147 Third st., Sterling, Ill.
* Priest, A. N.	Utica, N. Y.
Pruyne, Chas. P.	70 Dearborn st., Chicago, Ill.
Rawls, A. O.	Lexington, Ky.
Robinson, J. A.	Jackson, Mich.
Rehwinkel, F. H.	Chillicothe, Ohio.
Rhein, M. L.	New York City.
d Rose, A. G.	Cincinnati, Ohio.
* Starbuck, W. C.	Jamaica Plain, Mass.
Shepard, L. D.	100 Boylston st., Boston, Mass.
* Stockton, C. S.	Newark, N. J.
d Smith, G. W.	Fourth and Smith sts., Cincinnati, Ohio.
Smith, H. A.	Cincinnati, Ohio.
Shepard, Geo. L.	Sedalia, Mo.
Smith, A. Wilkes	Richmond, Ky.
Stewart, S. D.	Akron, Ohio.
* Smith, E. H.	Boston, Mass.
Taft, J.	Cincinnati, Ohio.
Trueman, W. H.	900 Spruce st., Philadelphia, Pa.
Thomas, Geo. R.	Detroit, Mich.
Templeton, J. G.	Pittsburg, Pa.
* Tillinghast, W. H.	220 Westminster st., Providence, R. I.
d Watt, Geo.	Xenia, Ohio.

d WALDRON, F. H. . . .	Canal Dover, Ohio.
WATLING, J. A.	Ypsilanti, Mich.
WENDEL, W. D.	Room 2, Iron Block, Milwaukee, Wis.
WRIGHT, C. M.	280 West Seventh st., Cincinnati, Ohio.
WILLIAMS, I.	New Philadelphia, Ohio.
WILSON, GEO. H. . . .	Painesville, Ohio.
WILSON, I. P.	Burlington, Iowa.
d WELLS, GRAHAM A. . . .	Indianapolis, Ind.
* WERNER, J. G. W. . . .	Upton st., Boston, Mass.

The following sent their dues:

CLEMENTS, C. W., for 1881, . .	Manchester, N. H.
WILSON, C. P., for 1881, (withdrawn)	Boston, Mass.
RICHTER, R. G., for 1880–81, .	Milwaukee, Wis.
KITCHEN, C. A., for 1881, . .	Rockford, Ill.

An address of welcome was then delivered by Dr. A. Berry, of Cincinnati, which was responded to by Dr. W. C. Barrett, of Buffalo.

On motion, the reading of the printed minutes was dispensed with.

The Committee on Credentials made a partial report, which was subsequently completed as follows:

Cincinnati Dental Society—C. M. Wright, A. G. Rose, G. W. Smith, O. N. Heise, W. Hart Cameron.

Chicago Dental Society—J. N. Crouse.

Detroit Dental Society—Henry Cowie.

Harvard Odontological Society—Horatio C. Meriam.

Illinois State Dental Society—A. W. Harlan, George H. Cushing, John M. Hurtt, K. B. Davis, James W. Cormany, D. J. Pollock, T. W. Brophy.

Indiana State Dental Association—Seneca B. Brown, P. G. C. Hunt, G. F. Nevins, J. E. Cravens, John R. Clayton, John B. Morrison, Graham A. Wells.

Iowa State Dental Society—L. C. Ingersoll, I. P. Wilson, S. A. Garber, W. O. Kulp.

Kentucky State Dental Association—R. C. Morgan, W. H. Goddard, C. E. Canine, A Wilkes Smith, W. M. Garnett, C. E. Dunn.

Michigan State Dental Association—George R. Thomas, W. H. Dorrance, E. C. Moore, J. A. Robinson.

Mississippi Valley Association of Dental Surgeons—W. D. Kempton, J. R. Callahan, Otto Arnold.

Missouri State Dental Association—John G. Harper, A. H. Fuller, George L. Shepard, W. H. Eames.

New Orleans Odontological Society—George J. Friedrichs, Joseph Bauer.

Northern Ohio Dental Association—T. C. Leiter, Frank H. Waldron, Gale French, J. G. Templeton.

Odontological Society of Western Pennsylvania—H. W. Arthur.

Ohio State Dental Society—E. G. Betty, J. H. Boger, Ira Brown, C. H. James, George Watt, W. P. Horton, I. Williams, C. I. Keely.

Pennsylvania State Dental Society—C. N. Peirce, E. T. Darby.

Pennsylvania Association of Dental Surgeons—W. H. Trueman, T. L. Buckingham.

Pittsburg Dental Association—W. H. Fundenburg.

St. Louis Dental Society—W. N. Morrison.

Tennessee Dental Association—H. W. Morgan, R. R. Freeman.

Washington City Dental Society—W. Warrington Evans.

Wisconsin State Dental Society—W. D. Wendel, B. G. Marcklein.

The report of the Publication Committee was then read, as follows:

The Publication Committee would respectfully submit the following report:

In accordance with the instructions of the Association, they perfected arrangements with The S. S. White Dental Manufacturing Company, whereby the Transactions were furnished free of cost to the Association.

Copies of the Transactions have been furnished to all members entitled to them, and to the various libraries, universities, journals, and honorary members, leaving in the hands of the Secretary about thirty copies.

The committee also had printed five hundred copies of the Constitution.

The late date at which the Transactions were distributed was owing to circumstances which your committee could not control. The stenographer, owing to sickness, did not furnish a copy of the discussions until three months had elapsed after the meeting in New York, and after the copy was placed in the hands of the publishers, great delay attended the progress of the work, and the Transactions were only received by the committee on June 7th, on which day they were mailed to the members.

The following is the account of the committee with the Association:

Received of the Treasurer		$75 00
From sale of Transactions		2 00
		$77 00
Expended for postage	$25 00	
" " Constitutions	18 00	
" " postal cards and printing	5 50	
" " packing boxes	5 50	
" " valise for papers	5 75	
" " copying, stationery, expressage, etc	20 15	$79 90
Balance due the Committee		$2 90

Respectfully,

GEORGE H. CUSHING, *Chairman.*

CINCINNATI, August 1, 1882.

We have examined the within report and found it correct.

J. N. Crouse, } *Ex. Com.*
Edwin T. Darby, }

On motion, the programme offered by the Local Committee, with slight amendments, was adopted.

On motion, the time for selecting the next place of meeting, the election of officers, and the organization of Sections, was made the special order of business for 2 o'clock P.M., Thursday.

On motion of Dr. Crouse, the following committee was appointed to draft a memorial respecting the death of Dr. M. S. Dean: Drs. J. N. Crouse, C. N. Peirce, and L. D. Shepard.

On motion of Dr. Barrett, the Secretary was instructed to extend, by telegraph, the sympathies of the Association to Dr. M. H. Webb, now lying seriously ill at his home in Lancaster, Pa.

In accordance with these instructions, the following telegram was forwarded:

"The American Dental Association extends its sympathies to Dr. M. H. Webb in his present sufferings, with the warm and confident hope that he may be with this Association again, in his wonted health, at its next annual meeting."

On motion of Dr. Field, the following committee was appointed to draft resolutions on the death of Dr. D. C. Hawxhurst: Drs. George L. Field, T. L. Buckingham, and J. Taft.

The amendment to the Constitution offered last year by Dr. Shepard, was then adopted, as follows:

To amend Article IV. of the Constitution, so as to make the present Article, Section 1 of Article IV., and to add a section as follows:

Sec. 2. The officers may, for extraordinary reasons, change the time and place of meeting upon the written consent of (10) ten of the (15) fifteen officers.

On motion, adjourned till 2 P.M.

FIRST DAY—AFTERNOON SESSION.

The Association was called to order at 2.30 P.M., President Smith in the Chair.

The minutes of the morning session were then read and approved, after which the President read his annual address.

On motion of Dr. Shepard, the vote taken this morning adopting the amendment to the Constitution was reconsidered.

Dr. Shepard moved that the amendment proposed be changed to read:

"The officers may, for extraordinary reasons, by giving at least thirty days' notice to each member, change the time and place of meeting upon the written consent of (10) ten of the (15) fifteen officers."

The President ruled the amendment out of order. The question then recurred on the original amendment as adopted this morning, when it was again adopted.

On motion of Dr. Morgan, so much of the President's address as referred to etiology and to education, was referred to the proper Sections.

Sections IV., V., VI., VII., I., and II., were called in the order named, but none were ready to report.

Section III. was called, and a report on Nomenclature and Terminology was read by W. H. Atkinson, chairman of the Section.

Dr. Watt moved that the report on Nomenclature be referred to a special committee of five, of which the mover should not be one.

Discussed by Drs. Rehwinkel, Watt, Robinson, and E. Hunter.

Dr. Crouse moved to lay Dr. Watt's motion on the table. This was lost.

Dr. Watt's motion was further discussed by Drs. Horton, Shepard Crouse, and Watt.

The motion was then put and was adopted.

The Chair appointed as that committee, Drs. C. N. Peirce, George J. Friedrichs, F. M. Odell, F. H. Rehwinkel, and George W. Keely.

The committee subsequently reported the following:

The special committee to whom was referred a paper on Philology, read by Dr

W. H. Atkinson as chairman of the Section on Dental Literature and Nomenclature, would respectfully report, that they have carefully considered the subject referred to them, and are of the opinion that the paper under consideration is foreign to the purpose of the Section under which it was read, and that if the Association desire further communications upon general philology, a Section of that title should be created; but in view of the fact that, at previous meetings of this Association, similar papers have been received without adverse criticism, they would suggest that this one be allowed to take the usual course, and go with other reports to the Publication Committee.

(Signed) C. N. Peirce, *Chairman.*
F. H. Rehwinkel,
George J. Friedrichs,
George W. Keely,
Frank M. Odell.

The report on Literature was not ready.

The Committee on Credentials made a supplementary report.

The Executive Committee reported that they had audited the report of the Publication Committee and found it correct. Their report was adopted. They also reported that they had audited the Treasurer's report and found it correct.

On motion, adjourned.

SECOND DAY—MORNING SESSION.

The Association met at 9.30 A.M., President Smith in the Chair.

The minutes of the afternoon session were read and approved.

Dr. Goddard offered the following:

Resolved, That from and after this date, the Treasurer of this Association shall be required to give such bonds for the faithful discharge of the duties devolving upon his office, as the second division of the Executive Committee may deem necessary, and his predecessor shall not surrender the funds, books, or papers, until he is informed by said Executive Committee that such bonds have been executed.

This was adopted.

On motion, the privileges of the floor were accorded to Prof. Mayr, of Springfield, Mass., and to Prof. Stubblefield, of Nashville.

Section IV. being called, submitted the following brief report:

Section IV. regrets that it has but one paper to present, the subject of which is, "Some Thoughts on Regulating Teeth," which it recommends should be read. The Section would also bring before the Association Dr. Coffin's method of treating irregularities of the teeth by the use of rubber plates and piano-wire, which will be thoroughly described by a member of the Section; and would also suggest the desirability of a thorough discussion of the various new methods of ingrafting artificial crowns upon natural roots.

EDWIN T. DARBY, *Chairman.*

A paper on irregularities was then read by W. N. Morrison, of St. Louis, and the subject was discussed by Drs. Atkinson, Peirce, Shepard, Darby, McKellops, Noel, Field, Eames, Butler, Dorrance, Keely, Crouse, Marcklein, and Morrison.

Adjourned till 1.30 P.M.

SECOND DAY—AFTERNOON SESSION.

The Association was called to order at 2 P.M., President Smith in the Chair.

The minutes of the morning session were read and approved.

The committee appointed to draft resolutions respecting the death of Dr. Hawxhurst made their report, which was adopted, and will be found in the memorial pages.

Section VI. being called, a paper was read by Dr. A. O. Rawls on Pathology, and one by A. W. Harlan, on Therapeutics. They were discussed by Prof. Mayr and Drs. Ingersoll, Peirce, Friedrichs, Morgan, Rawls, Watt, Buckingham, and Atkinson.

Adjourned till 9 o'clock to-morrow.

THIRD DAY—MORNING SESSION.

The Association met at 9.30 A.M., the President, Dr. Smith, in the Chair.

The minutes of the afternoon session were read and approved.

The consideration of subjects in Section VI. was then resumed, and a paper on "Diatheses and Cachexiæ" was read by Dr. F. M. Odell, chairman of the Section.

This was discussed by Drs. Atkinson, Friedrichs, Buckingham, Watt, Kulp, Odell, Prof. Mayr, and Drs. Darby and Thomas.

Section VI. was passed.

On motion, the regular order was suspended, and the committee appointed to draft a memorial touching the death of Dr. M. S. Dean made their report, which was unanimously adopted, and will be found in the memorial pages.

The Committee on Voluntary Essays reported, recommending that the paper which had been placed in their hands be not read. The report was adopted.

They further reported that another paper had just now been placed in their hands, upon which they were not ready to report. They were granted further time.

Section VII. being called, made the following report:

Section VII. begs leave to report that but one paper has been presented to the Section, which they recommend be read to the Association. The paper is by W. C. Barrett, of Buffalo, and is entitled: "The Origin and Physiology of Nervous Force."

With reference to that part of the President's address on the subject of Etiology which was referred to it, the Section, in accordance with the suggestion of the President, begs leave to offer the following resolution:

Resolved, That the sum of two hundred dollars be set apart to be awarded by a special committee of three members of this Association to be appointed by the President, to the author of the best paper upon the Etiology of Dental Caries, the paper to be based upon strictly original investigation, and to be presented to this Association in the report of Section VII.

Said committee shall prescribe the conditions upon which essays shall be presented, and in case two or more papers of equal claims to merit shall come before them they may in their discretion divide the sum so set apart and award a portion to each essayist. Unless papers of sufficiently original merit be submitted, the committee may decline to award the prize, and hold it over until, in their opinion,

it has been fairly earned. The competitors for this prize need not be members of this Association, but the profession of the world is invited to the consideration of the subject.

(Signed) W. C. Barrett, *Chairman*,
E. Hunter, *Secretary*.

The paper by Dr. Barrett was then read and was discussed by Dr. Buckingham.

The organization of Sections then took place, as follows:—

Section I. Artificial Dentistry, Chemistry, and Metallurgy.—T. L. Buckingham, Chairman; J. G. Harper, Secretary; C. S. Stockton, W. H. Fundenburg, W. H. Dorrance, C. H. Harroun, H. H. Keith, D. D. Smith, J. Hooper, C. E. Canine, D. S. Dickerman, George L. Shepard, A. G. Rose, Charles E. Dunn, E. Honsinger, Wm. H. Trueman, I. Douglass, J. C. Whinery, Thomas H. Chandler, S. A. Garber, John Allen, W. W. Evans, J. F. Adams, L. L. Buckland, J. E. Blake, C. Bullock, Eben M. Flagg, Lyman C. Bryan, Jacob H. Boger, C. W. Clements, C. C. Carroll, Geo. F. Grant, Jas. Cleland, W. P. Church, E. S. Holmes, S. M. Cummings, H. W. Coburn, F. A. Hunter, J. O. Cook, M. L. Chaim, O. N. Heise, E. B. Davis, Miles H. Dodge, O. F. Harris.

Section II. Dental Education.—L. D. Shepard, Chairman; T. W. Brophy, Secretary; J. N. Crouse, C. N. Peirce, J. E. Lyman, J. G. Templeton, John M. Hurtt, N. Morgan, K. B. Davis, W. W. Allport, C. W. Meloney, W. N. Morrison, W. H. Morgan, W. E. Magill, George R. Thomas, P. G. C. Hunt, D. C. McNaughton, C. M. Wright, C. J. Essig, S. J. McDougall, Chas. H. Osgood, Wm. Barker, J. I. McCampbell, Thos. Fillebrown, C. D. Cook, J. T. McMillen, A. Colton, S. W. Dennis, H. B. Noble, P. K. Filbert, A. W. Freeman, E. S. Talbot, S. A. Freeman, G. A. Gerry, W. M. Garnett, D. B. Ingalls, W. H. Jones, H. H. Jackson, G. W. Klump, C. A. Kitchen, S. E. Knowles, D. C. Kelly, W. B. Knapp, Jos. Lathrop.

Section III. Dental Literature and Nomenclature.—J. Taft, Chairman; F. H. Rehwinkel, Secretary; Geo. J. Friedrichs, W. H. Atkinson, C. A. Kingsbury, Seneca B. Brown, W. A. Bronson, Chas. E. Francis, J. L. Hill, George A. Mills, Thos. T. Moore, Chas. Merritt, W. S. Moses, A. L. Northrop, E. Osmond, Jas. G. Palmer, Edgar Palmer, J. A. Robinson.

Section IV. Operative Dentistry. — E. T. Darby, Chairman; H. J. McKellops, Secretary; E. G. Betty, W. D. Kempton, C. I. Keely, Geo. L. Field, W. O. Kulp, Gale French, I. P. Wilson, G. F. Nevins, I. Brown, B. G. Marcklein, G. W. Smith, J. W. Cormany, W. H. Goddard, M. F. Finley, G. W. Keely, Geo. H. Wilson, H. C. Meriam, W. D. Wendel, J. A. Watling, J. R. Clayton, F. H. Waldron, E. C. Moore, E. S. Gaylord, W. C. Starbuck, S. G. Stevens, J. N. Farrar, W. E. Page, C. W. Partridge, G. B. McDonald, Jas. McManus, I. Williams, J. R. Callahan, J. B. Coolidge, R. G. Richter, H. K. Leech, S. B. Palmer, G. A. Young, L. G. Noel, H. M. Ambler, D. F. Whitten, Chas. F. Allan, Jos. Bauer, C. A. Woodward, R. W. Browne, H. A. Baker, Geo. S. Meigs,

A. N. Priest, A. L. Pettee, J. Frank Marriner, C. B. Parker, D. J. Pollock, F. J. Richards, S. G. Perry, E. A. Bogue, J. W. Rhone, Chas. R. Butler, G. Carleton Brown, J. H. Smith, A. H. Brockway, D. M. Clapp, T. C. Stellwagen, J. F. Canine, D. W. Clancey, J. A. Swasey, Wm. Dutch, G. C. Daboll, F. N. Scabury, A. F. Emminger, A. H. Fuller, S. D. Stewart, R. R. Freeman, S. H. Guilford, E. H. Smith, J. S. Hurlbut, G. W. Hoysradt, C. S. Hurlbut, Robt. Huey, E. D. Swain, Wm. Jarvie, Jr., Benj. Lord, W. H. Tillinghast, W. T. LaRoche, W. P. Leavitt, M. V. Toledo, J. E. Lyman, J. U. Lee, M. H. Webb.

SECTION V. Anatomy, Histology, and Microscopy.—Geo. H. Cushing, Chairman; Frank Abbott, Geo. F. Waters, S. E. Davenport, R. R. Andrews, Chas. P. Pruyne, J. Adams Bishop, M. L. Rhein, I. B. Davenport, C. F. W. Bödecker, A. W. Buckland, R. W. Tenney.

SECTION VI. Pathology, Therapeutics, and Materia Medica.—F. M. Odell, Chairman; A. M. Dudley, Secretary; A. W. Harlan, A. O. Rawls, Otto Arnold, L. C. Ingersoll, Wm. Taft, W. H. Colgrove, C. A. Brackett, Wilbur F. Litch, C. S. Beck, S. C. G. Watkins.

SECTION VII. Physiology and Etiology.—W. C. Barrett, Chairman; W. P. Horton, Secretary; H. A. Smith, E. Hunter, A. Wilkes Smith, W. Storer Howe, Henry W. Morgan, Leon Rideout, Flavius Searle, E. S. Niles, J. G. W. Werner, C. T. Stockwell.

Adjourned till 2 P.M.

THIRD DAY—AFTERNOON SESSION.

The Association met at 2 P.M., the President in the Chair.

The minutes of the morning session were read and approved.

The Committee on Voluntary Essays made the following report, which was adopted:

Your Committee on Voluntary Essays to whom was referred the paper of Dr. Jos. Richardson—on "Reflex Lesions of the Oral Cavity Associated with Pregnancy," would respectfully report that the communication is one of merit and worthy of consideration by this Association, but as the author is not a member, they decline to make any recommendation respecting its being read, preferring to report the paper back to the Association for its decision upon its presentation.

Signed by

Committee, { C. N. PEIRCE, *Chairman*,
W. H. MORGAN,
F. H. REHWINKEL.

Dr. Buckingham moved that the paper be read.

Dr. Crouse offered as an amendment, that the paper be *not* read until after the Sections have reported.

The motion as amended was adopted.

The special order being now called, the Association proceeded to ballot for the place of next meeting. Niagara Falls was chosen.

Balloting for officers then followed, resulting in the election of the following:

President—W. H. Goddard, of Louisville, Ky.
First Vice-President—George J. Friedrichs, of New Orleans, La.
Second Vice-President—E. T. Darby, of Philadelphia.
Corresponding Secretary—A. W. Harlan, of Chicago.
Recording Secretary—Geo. H. Cushing, of Chicago.
Treasurer—Geo. W. Keely, of Oxford, Ohio.
Executive Committee—J. N. Crouse, A. M. Dudley, Geo. L. Field.

Adjourned till to-morrow at 9 A.M.

FOURTH DAY—MORNING SESSION.

The Association was called to order at 9.30, the President, Dr. Smith, in the Chair.

The minutes of the afternoon session were read and approved.

On motion, the Treasurer was instructed to pay all properly authenticated bills, and to notify all members in arrears.

The regular order being resumed, the consideration of Section VII. was continued. Discussed by Dr. Barrett.

On motion, the resolution submitted by Section VII., offering a prize for the best essay on the Etiology of Dental Caries, was adopted.

Dr. Atkinson moved that the blank in the resolution just adopted be filled by naming the sum of five hundred dollars.

Dr. Taft offered an amendment substituting two hundred dollars.

The mover accepted the amendment, and as amended the motion prevailed.

The President appointed as the special committee called for by the above resolution, Drs. C. N. Peirce, W. A. Bronson, and E. T. Darby.

Section VII. was passed.

Section I. being called made the following report:

Section I. would respectfully report that they suggest to this body for its consideration a paper on Celluloid, by the chairman, Dr. Buckingham, of Philadelphia. They would also call attention to a material for filling teeth presented by Dr. Robinson, of Michigan, to a material known as Reese's metallic base for artificial teeth, presented by Dr. Atkinson, of New York, and to a formula for an alloy for making solder, and a blow-pipe, presented by Dr. Dorrance, of Michigan.

(Signed) T. L. BUCKINGHAM, *Chairman.*

The paper by Dr. Buckingham was then read, and discussed by Drs. Atkinson, Buckingham, Robinson, and Hurtt. A paper on the ill effects of plastic bases, by Dr. Dorrance, was then read.

On motion, Dr. Dorrance was requested to secure the manufacture of his blow-pipes to enable the profession to obtain them.

Section I. was passed.

On motion it was voted to install the newly-elected officers immediately after convening this afternoon.

Dr. Crouse moved that the sum of three hundred dollars be appropriated from the treasury, to be expended at the discretion of a committee to be appointed, for the purpose of securing the scientific tabulation of the skulls of the various collections held in this country. Carried.

Adjourned till 2 P.M.

FOURTH DAY—AFTERNOON SESSION.

The Association met at 2.15 P.M., the President in the Chair.

The minutes of the morning session were read and approved.

The newly-elected President, Dr. W. H. Goddard, was then installed and made the following remarks:

GENTLEMEN,—Having been elected very unexpectedly, and without solicitation, to the Presidency of this body—a position the highest in the gift of my professional brethren to bestow—I feel constrained at the outset to say that while I appreciate and am grateful for the honor conferred, I doubt my ability to discharge the duties incumbent upon the office.

The presiding officer of such an intelligent and scientific body as the American Dental Association should have great executive ability as well as a thorough familiarity with parliamentary practice,—qualities which I fear I do not possess.

But we live in a progressive age, our watchword being "onward and upward," and so we all strive, I hope, to attain the good things not yet our own.

I have confidence that the same courtesy and assistance I have always received from the members of this Association in the discharge of the duties of my late office, will be extended to me in the discharge of those now devolving on me, and whatever errors I may commit will be "of the head, not of the heart."

Inviting, then, the same co-operation and assistance as heretofore, and trusting that the good angels will hover above and about me, inciting and inspiring me to every good work and effort, I cordially thank you for the honor conferred, and assume the gavel with an earnest and, I trust, not unreasonable hope of success.

Dr. Crouse moved a reconsideration of the vote of this morning appropriating three hundred dollars for tabulating skulls. Carried.

The question being put again on the original motion to appropriate was lost.

Section III. being again called, Dr. Taft read a paper on Literature. Discussed by Prof. Mayr.

Section II. was then called, and a report was made by Dr. Crouse, the chairman.

On motion of Dr. Peirce, the following was adopted:

Resolved, That during the consideration of the subject of Dental Education, the speakers shall be limited to five minutes, and no one shall speak more than once, without unanimous consent, until all who wish to speak have spoken.

Education was then discussed by Drs. Robinson, Atkinson, Peirce, Barrett, Taft, Allport, Buckingham, Morgan, Brophy, Kulp, and Hunter.

The subject was passed, and miscellaneous business taken up.

The Committee on Credentials made their final report, which was adopted.

The President appointed as the Local Committee of Arrangements Drs. Barrett, Butler, and Field.

Also on Publication Committee, Drs. Darby, of Philadelphia, and Harlan, of Chicago.

On motion of Dr. Peirce, the following was adopted:

Resolved, That the Publication Committee be and are hereby authorized to use their discretion in the matter of printing the Transactions, under the instructions given them by the resolution passed at Boston in 1880. Also,

Resolved, That the thanks of this Association be and are hereby tendered to such of the press and reporters as have properly reported us, to the officers of this Association, to the Local Committee, and to the resident professional gentlemen and citizens who have contributed to our pleasure and comfort during the sessions of this body; also to such of the railroad companies as have honored their obligations in accordance with the agreements made with the Local Committee of Arrangements.

Prof. Stubblefield, of Vanderbilt University, Tennessee, was introduced, and made a few remarks.

On motion of Dr. Taft, the thanks of the Association were tendered to Mr. Harff, the proprietor of Highland Hall, for his generous donation of its use to the Association, and for the many services rendered in various ways.

The following, offered by Dr. Noel, was referred to the Section on Education, they to report on it next year:

Resolved, That this Association recommends to the various dental colleges of this country, the organization of an association of colleges for the purpose of securing concerted action as to what shall be required of students, both upon entering and leaving those institutions; and that in case such an association is formed, no college refusing to abide by the action of the College Association shall be recognized by the American Dental Association

The report of the Executive Committee auditing the Treasurer's report was adopted.

The following notice of amendment to the Constitution was filed:

"All resolutions appropriating money, except for the legitimate expenses of this Association, shall require a two-thirds vote of all the members present."

The minutes were then read and approved, and the Association adjourned to meet at Niagara Falls on the first Tuesday in August, 1883.

Notice of amendment to the Constitution offered by Dr. Allport.

To amend Article V. Section 1, as follows: On line *four*, after the words "Executive Committee," strike out all the remaining section, and insert "All candidates for office shall be put in nomination by a committee appointed for that purpose, consisting of one member from each Section of the Association appointed by such Section, who shall put in nomination three candidates for each office of the Association. When the nominations are made, the election shall be by ballot in the order named in the Constitution. In case no candidate receives a majority of all the votes on the first ballot, the candidate receiving the lowest number of votes shall be dropped, and the ballot shall be taken upon the two remaining candidates, and the one receiving a majority of the votes shall be declared elected."

[The above was handed to the Secretary too late to appear in its proper place in the minutes.]

IN MEMORIAM.

M. S. DEAN.

In the uncertainty of life we are called upon to record the death of our beloved friend, brother, and associate, Dr. M. S. Dean, of Chicago. In this sad bereavement we have lost the companionship of one who was original and progressive in thought, though calm and conservative in action, and just and charitable in expressing his convictions. Possessing keen perceptions, delicate sensibilities, and refined tastes, he was pure, warm-hearted, and sympathetic in nature; genial, humorous, witty, and at times even boyish and exuberant in spirits. With these attributes governing his life, he enjoyed to an unusual degree the confidence and affection of his associates, while with those who had the good fortune to be his personal friends, his name will ever remain a household word, clothed with only bright and happy memories.

In the death of our associate *we* have lost a scholarly, cultivated and generous friend, who has filled with honor and great satisfaction every responsible position at our disposal. His brilliant intellect, varied attainments, earnest, honest, and modest bearing, made him not less dear to our scientific friends abroad than to us. In his visit to Europe within the past year, the profession at home, with which he was so closely identified, was honored in being represented in the International Medical Congress by a man possessing such rare accomplishments.

In closing the honored grave of Dr. Dean, the dental profession has lost a member of whom it has justly been proud, and the community in which he labored a thoroughly attached citizen, earnest in his devotion to its interests, keenly alive to every improvement, and active in every movement calculated to increase its prosperity.

Resolved, That a copy of this expression of our appreciation of Dr. Dean, with the assurance of our sympathy, be sent by our Secretary to his relatives, and also be recorded upon a memorial page in our Transactions.

D. C. HAWXHURST.

WHEREAS, It has pleased our Heavenly Father, in his goodness and wisdom, to remove from among us in a foreign land and among strangers, and to call to his eternal home, our friend and brother, Dr. D. C. Hawxhurst; and

WHEREAS, In the severing of these earthly bonds, our heads are bowed in sorrow; therefore

Resolved, That we deem it proper at this time to give to the world an expression of our feelings over the sad loss that we have all sustained.

Resolved, That in Dr. Hawxhurst we recognized capabilities, and a promise of a greater sphere of usefulness than fell to the lot of many of his years; modest and unassuming as he always was, still the glory of a brilliant career, the result of indomitable energy, perseverance, and deep research, seemed ever breaking forth from his soul, giving promise of a rich and useful life in the future.

Resolved, That while we bow our heads and hearts in submission to the rod that smites, still in all sincerity we say "Thy will, not ours, be done."

Resolved, That these resolutions be spread upon the records of this Association, and also that our Secretary be instructed to forward a copy of the same to the stricken wife, to whom we extend our most heartfelt sympathy in this, her hour of bereavement and sorrow.

Dr. Rehwinkel: I think Dr. Dean was a man who deserves more than the ordinary notice of condolement. Those only who knew Dr. Dean well could fully appreciate him. He was a man whom you liked better and better the more you knew of him. A man, perhaps through his extraordinary modesty and retiring disposition not so easily approached as those more forward, but who, once known and his confidence gained, would inspire a fully reciprocal confidence. I have in my life met but few men to whom I would rather have gone on an occasion when I had altogether lost faith in my own judgment, and on whose judgment I would more trustingly have relied. When I received notice through the daily papers of his death I was so unmanned for awhile that I had not the strength to hold the paper in my hands.

There was another man who has joined the grand army above, during the last year, a man not so well known as Dr. Dean, but one who seemed destined to be a bright light in the future—a young man who gave promise of a very useful and profitable life. I allude to Dr. Hawxhurst, of Michigan. I think this Association honors itself by paying proper tribute to both of these departed brethren.

Dr. Thomas: When men pass from among us who give promise of such eminence as did our friend, Dr. Hawxhurst, it is well to spend a little time in commemoration of their good qualities.

Dr. Hawxhurst was a dear friend of mine, and I love to dwell on his memory. The death of Dr. Dean was followed so soon by tidings of that of Dr. Hawxhurst that we are forcibly reminded that "one woe doth tread upon another's heels, so fast they follow."

As has been said of our friend, Dr. Dean, Dr. Hawxhurst was a man not easily approached with familiarity, but when once his confidence was gained you felt that you had won a prize which you would not relinquish. The more he was known the more highly was he esteemed, and I venture to say there is not a man in this room who ever heard a fellow-practitioner say aught against him in life or death.

The first time I ever met him was in Michigan, in 1869, I being one of the Board of Censors to examine candidates for admission into our State society. Upon his presenting himself for admission, I was at once impressed with his thoughtful manner and his modesty, and at the same time his evident ability. He approached almost an extreme of caution in treatment of difficult cases, as an incident will show. I had under treatment at that time a case of diseased antrum that was causing me no little trouble and annoyance, and feeling the need of some good advice on the subject, I gave him a diagnosis of the case, and asked what he would do under such circumstances. After waiting a moment, he said: "I never had a case like that. I have heard about them, and have seen them in other men's hands, but I have never had one myself." "Well," I said, "if you *had* such a case as that, what would be your first step?" He said, "I should think about it over-night before I did anything." I asked him what he would do next day. "Well, if I was not perfectly sure what to do, I should think about it another day and night before I proceeded to treat the case." But, I said, suppose your patient is suffering and needs immediate treatment, and the suffering is increased by delay? He replied, "I should much prefer that my patient should suffer from that cause than to increase the trouble by treating it improperly."

A very warm friendship sprang up between us at that time, and in the years that have passed since has steadily increased. His "leaf has perished in the green," but surely his desire for higher knowledge, and his constant labor to attain it; his unassuming modesty and lack of all professional jealousy, may be an example to us that we should not be slow to follow. Long live the memory of Dr. D. C. Hawxhurst.

Dr. Harroun: At a meeting of the Michigan State Dental Society held at Adrian several years since, Dr. Hawxhurst reported a case in practice, giving his mode of treatment, and asked the question why he had failed. It occurred to me that he had not properly understood the nature of the case and I asked him what was the condi-

tion before treatment commenced. The little shot was well aimed and did good work; he saw the point and frankly admitted he had not given that most important part any thought whatever, but from this time on it should have his first consideration. Several articles on diagnosis were written and read by Dr. Hawxhurst in due time, which showed he was in earnest ever afterwards. In the few years which followed the above circumstances in Dr. Hawxhurst's life, we who knew him saw he meant to have a place second to none in the profession he had chosen.

Dr. Crouse: Probably there are few, if any, who knew Dr. Dean more intimately than it was my privilege to know him. The older members of this Association knew, respected, and loved him, and will cherish his memory. By the members as a whole, he was not perhaps as well known, because of his natural reserve, and because many of the members are comparatively new to the Association. One could not know Dr. Dean intimately without becoming strongly attached to him.

The purity and honesty of his nature shone forth in all the acts of his life. He was a man of warm sympathies, very practical in all his ideas, and hated show and sham more than any other person I have ever met. He was also a man of keen perception and one of the best judges of human nature I have ever known. His unfavorable criticisms of men and acts were always coupled with the broadest charity. He possessed as kind and generous a heart as ever beat in human breast. He was to me the truest friend and wisest counsellor I have ever had. While his loss is irreparable, I am grateful for the years we have spent together.

Address of Welcome.

By A. BERRY, of Cincinnati.

Mr. President and Members of the American Dental Association:

THE partiality of my brethren has imposed on me the pleasing duty of welcoming you to the Queen City. It were better had this been assigned to some one who could give a more fitting expression of our feelings, but I yield to no one in the heartfelt pleasure your presence gives us. Indeed, this large and imposing convention must be gratifying to you all.

From the position of our city, the center of the population of our country, it is convenient for conventions to meet here. Several have done so this year, and our city is fast acquiring the name of the "city of conventions." In character and importance none of those which have gone before us surpasses this.

Ours is the youngest of the professions. As compared with the others it is in its infancy, but it is our just glory that in the last forty years it has made greater progress than any of the others. Much of this is due to American dentistry, whose pre-eminence is acknowledged the world over.

Other professions may have more high-sounding pretensions, but our mission is the relief of human suffering, often the most poignant, and the preservation or substitution of organs vastly important for health, comfort, and beauty. It is not to be forgotten that the greatest discovery of modern times in surgery—anæsthesia—is a discovery of our profession.

But let us not rest on our past laurels; let us press forward; let us demand that no one be admitted to our brotherhood unless he has the education to fit him for its duties; let our standards be raised higher and higher.

During the sixteen years which have elapsed since you held your annual convocation here, the dental societies, dental colleges, and dental periodicals of our country have more than doubled in num-

ber. There has in this time been a steady progress of our profession in which your Association had a leading part. While in these years all other departments of science have made important advances, the dental profession has, perhaps, outstripped them all. This was formally acknowledged last year by those best able to decide. The American Medical Association and the International Medical Congress recognized dentists as belonging to the fraternity engaged in the practice of the healing art.

You have before you evidence of the great development of the resources of this region in its material and educational interests, since you last held your convention here.

The Southern railroad, three hundred and thirty-six miles in length, representing $20,000,000 of Cincinnati finances, with its extensive Southern connections, facilitating commercial and social relations, promotes fraternal feeling between the people of distant sections of our Union.

You look down on three substantial structures spanning the stream which the æsthetic French call the "Beautiful River;" on one of the largest and best Music Halls; on McMicken University, where thorough instruction is given to pupils of this city of either sex, without money and without price; on our large Public Library building with its stores of learning; and on the most beautiful fountain ever erected. You will find visits to our Astronomical Observatory, and our Zoological Garden pleasing and instructive.

You are surprised when you recollect that here, less than one hundred years ago, was the home of the red man, undisturbed in his rights by the pale face. In its eleemosynary institutions our city is abreast of the advanced civilization of the age. The large and commodious Cincinnati Hospital, controlled and supported by the city, the extensive Betts Street Hospital, with several others sustained by that church whose charity is bestowed on all suffering applicants, without regard to race or creed, our Orphan Asylums, Children's and Old People's Homes, and other charities, minister abundantly to the wants of the needy poor and suffering among us.

In munificent bequests for educational and art purposes, Hughes and Woodward with their High Schools, McMicken with his University, Springer with his Music Hall, Davidson with his Fountain, and West with his large donations for the construction of a grand edifice to contain the treasures of our Art Museum, and a perpetual endowment fund, have set an example worthy of imitation by millionaires of other cities.

You see the spot where was founded the second dental college in the world, and where was organized the Mississippi Valley Dental Association, which for more than a score of years has been the oldest dental society in existence.

Gentlemen, the Mississippi Valley Dental Association, the Ohio State Dental Society, and the dental profession of this vicinity, extend to you a hearty welcome to Cincinnati. May you have a pleasant and profitable reunion.

Annual Address.

By H. A. SMITH, President.

Gentlemen of the American Dental Association:

On the occasion of our anniversary, our first glance is usually retrospective, in memory of those once among our numbers, but who now survive only in their works. During the past year we have to record the death of one of our most valued associates, M. S. Dean.

It was my privilege to attend the last sad rites at the late home of the deceased, and the signal manifestation of affectionate regard for the man which followed the announcement of his death on the part of the members of this Association, where so many of us have felt for years the fascination that comes from contact with a superior intellect and a noble character, such as distinguished our late confrère, was heightened on that occasion by the almost sacred sorrow that overspread not only the group of immediate friends, but also the large number of professional associates who were in attendance.

The death of Dr. Dean may not, perhaps, be regarded as an irreparable loss, yet when we remember his genial, plain, and generous nature, his cheerful and animated conversation, the variety of his attainments, the extent and accuracy of his professional knowledge, coupled as they were with the modest self-estimate and humility of mind so characteristic of him; when we refer to the valuable contributions from him which grace the pages of our Transactions and add to the bulk of our real knowledge, recalling the great love which he bore for this Association, as manifested in the ever-watchful guardianship of its interests, whether as an humble worker in this body or as its honored President; surely the place in our Association made vacant by the death of Dr. Dean will be a difficult one to fill.

Gone is he! but he has left behind him "footprints on the sands of time."

The present annual meeting marks the completion of the twenty-first year of the existence of the American Dental Association, and as we are passing on in the full strength of our majority it may not be unprofitable if we refer briefly to the methods of work which

have been adopted from the beginning for the purpose of carrying out the objects of the Association. For a period of eighteen years, prior to 1878, the work of the Association was done through committees appointed annually. While we may not overestimate the extent and value of the labor accomplished during this period, we can justly refer with pride to a good number of the papers and reports presented to the Association as having led to direct results in the development and advancement of dentistry. Especially is this true in the departments of physiology, pathology, and histology, and in applied dentistry. From and since 1878, instead of reports by the annual committees, and essays from individual members, followed by discussions, we have submitted the annual reports of the permanent Sections and such volunteer papers as have been approved by the appropriate committee, to whom they are first referred. Only three annual meetings have occurred since the plan of permanent Sections was inaugurated, and yet we think the Transactions give evidence that there has been a gradual improvement in the character and worth of the matter brought before the Association for consideration during this period. Time in all affairs is an important element, and before we can hope to reap the full benefits contemplated by the change, the general membership of the Sections must be brought to fully understand the duties and responsibilities that attach to such a relationship in a body like ours. This is a labor that will largely fall on the principal officer of the Section during the first years. The position of chairman of a Section is of necessity one of great labor and responsibility, since it is implied in his duties that he shall supervise and conduct the work of this Section, and thus indicate to the members what questions most need immediate investigation, what problems need to be solved. In this way he will have assigned to every class of mind a definite task, and have suggested to them, "There is a shore of which the soundings should be more accurately taken, and there a line of coast along which a voyage of discovery should be made."

Having come of age, and entering as we are upon a period which in man indicates great bodily vigor, a rapidly developing mind, and a maturing judgment, with so much already achieved, and with such materials for future achievements, we may well indulge in fond anticipations of the possibilities for good of which this Association is capable, if the great objects for which it was founded are kept steadily in view.

In his address last year the President called attention to the fact

that etiology, the science of the causes of dental caries, had been almost wholly neglected by essayists who had contributed to the proceedings of the Association, and suggested to the Section embracing etiology, that a committee be appointed with the object of making a careful, systematic study of the causes which contribute to the existence of dental caries. Without definite knowledge as to what action this Section may have taken in reference to the very excellent suggestion of Prof. Peirce, I can only offer as an apology for bringing this matter before you so soon again, my firm conviction that there is no subject in the whole domain of the science of dentistry that could more profitably engage the earnest attention of this body; for when we consider that much the larger proportion of our time spent in actual practice is occupied in the treatment of lesions caused by the almost universally prevalent disease which we denominate dental caries, and that notwithstanding the subject has been extensively studied, the fact confronts us, that the efficient cause of dental caries is still a matter for speculation. It is noteworthy, as well as encouraging, that the subject received so large a share of attention before the section devoted to the consideration of diseases of the teeth at the International Medical Congress held in London last year. The papers read before the dental section relating to the underlying and specific causes of this morbid condition, enriched as they were by details of actual experiment and original investigation, were among the ablest and most valuable contributions to that scientific body. And in our own country the study of the minute structure of the several tissues of the teeth, and the investigations made in the direction of the pathology of dental caries by that group of earnest workers connected with the New York Odontological Society, under the lead of Carl Heitzmann, are indications that the dental profession are becoming more and more convinced that all methods of treatment based on any other than definite knowledge, in health and disease, of the tissues on which we work, are at best largely empirical. True dental science may include much more, but certainly it means no less than that when the specific disease which we denominate dental caries is recognized, the efficient causes producing the symptoms shall be known and demonstrable. Less than this is but half-knowledge, and indicates that the status of dentistry has not risen much above the level of an art.

With the view of stimulating investigation in this direction, I would respectfully suggest that this Association offer a prize to members of not less than $250, for the best paper, based upon

strictly original investigation, relating to the etiology of dental caries; the award to be made and announced at the annual meeting in 1884.

A reference to our printed Transactions will discover the fact, that the subject of dental education has received its full share of the time and attention of the Association. Our dental colleges, as Prof. McQuillen was pleased, on occasion, to remark, have been subject to an annual criticism. These strictures have usually been made in a friendly spirit, and no doubt have in a degree been potent in advancing the standard of dental educational institutions. Occasionally a spirit of impatience has been shown on the part of the "self-assured critic," that the defects which he thought he clearly saw, "did not flee at his bidding." It is to be feared that it was somewhat in this spirit that the resolution regarding dental colleges was adopted at the annual meeting in 1880. As might reasonably have been anticipated, the adoption of this resolution has called forth a protest on the part of some persons who are especially interested in the management of our professional schools, and in its essence the resolution is regarded by them, as well as by others of the profession, as having an "air of dictation not authorized by the power of this Association." This and similar strictures are made by men whose opinions we may not regard lightly, for they are among those who have labored long and efficiently in the cause of dental education in this country. The adoption, therefore, of a line of policy in reference to educational matters, methods of practice, or indeed in any direction that partakes in any degree of a dictatorial spirit, it must be evident, is unwise, and cannot but have a reactionary effect. The history of the attempt on the part of the American Society of Dental Surgeons to exercise the unwarrantable authority of dictating to members the modes of practice they should pursue, which had the effect to dissolve that organization, is fresh in the minds of most of us. Prescription in this instance meant proscription, and as a result death ensued. We may profit also by the experience of the American Medical Association in their numerous attempts during a period of thirty years or more to improve the system of medical education and elevate the standard of requirements for the medical degree, and all without any apparent good.

Dr. T. G. Richardson, in his admirable annual address before that representative body of American physicians in 1878, in reference to this very subject said: "The measures proposed from time to time were sufficiently incisive, and to all appearances admirably adapted

to the ends in view, but unfortunately there was no power in the association to carry them out, and they remain on the record as mere mementoes of the praiseworthy zeal of their authors. We have just now found out," he continues, "that the plan of making war directly upon the medical colleges, endeavoring to compel them to conform their practices to our theories, or else surrender the prerogatives to which they had been so long accustomed, was altogether a mistake, and probably deserved the partial defeat which it encountered. Indeed, I am not quite sure that the many blows which these institutions received at our hands served rather to compact them together, and thus to increase their power of resistance." These are certainly suggestive words, and in them we have an instance of history teaching by example.

Gradually there has been an improvement in the system of medical education. Step by step progress has been made in obedience to the inevitable laws which prevail alike in the world of matter and the world of man. "All things have a slant forward, but a gradual and a slight one," and the history of reform in medical education in this country is no exception to this law, as will be seen when I state that the first medical colleges were established before the war of the Revolution, and that now, after the lapse of more than a century, not more than half a dozen of the one hundred and upwards of medical schools have adopted the advanced or graded system of instruction and a three years' course of study as a requirement for the degree.

The whole system of dental education of to-day in the United States, as represented by the sixteen colleges or departments, situated in ten different States, with their eighty professors, aiding in the instruction of over eight hundred students, has been developed within a period of forty years. In this comparatively short time it is hardly to be expected that a uniform scheme of tuition or of time requirement should have been adopted in all the dental schools, especially when we recall the fact that not more than one-half of those who enter upon the practice of dentistry each year receive any other training than a limited pupilage with a private preceptor in a dental office. We are naturally impatient of results; are too apt to want the end without the means. And if, in our estimate of the status of dental education in this country, the facts I have mentioned, together with the other significant fact that a majority of those who are now in the practice of dentistry in the United States have no degree either in dentistry or medicine, are duly considered; then

we have every reason to congratulate ourselves that dental education occupies the advanced position which it does.

In bringing about these encouraging results, our social society organizations, local, state, and national, have been largely influential, and since our dental schools receive their material and moral support from the profession, it is of the highest importance that the power which this and similar organizations have in creating and directing professional sentiment, and indirectly in enlightening the people in regard to the necessity of thorough special training on the part of those who hold themselves out as competent to treat dental ailments, should be judiciously exercised.

The merits of the several systems of dental education now in vogue in this country are, very properly, subjects for discussion. But whether the education of dentists can best be accomplished in schools especially established for this object, or whether this special mode of making a living shall in future be taught in our universities in connection with other special modes of making a living; or, indeed, as has been proposed by the few in the profession, whether our special degree shall be abolished altogether, and the training essential to successfully practice dentistry shall be supplemental to the acquisition of the degree of M.D., which it is claimed is sufficient and should cover all departments of the healing art,—these are questions that may safely be left to time, the great arbiter of all things.

SECTION IV.

Operative Dentistry.

Some Thoughts on Regulating Teeth.

By WM. N. MORRISON, of the Section.

I HAVE been very forcibly reminded, lately, of the numerous errors continually committed by old and otherwise respected practitioners, and earnestly defended and imitated by their pupils or students, in the extraction of the sixth-year molars for so-called regulating purposes, it being claimed by them that complete success crowns their efforts in every instance. I very much lament that so much stupidity exists in the profession to-day, that the mistakes cannot be seen by looking at the articulation of any set of teeth, and the facial expression, where such extraction has been performed. It is a rare treat, at this day, to see a perfect arch with a correct articulation. These matters have become so much of a study with me, that when I see persons in the street I can nearly always tell when they have met with the irreparable loss referred to before looking into their mouths.

It is with joy that I welcome all helps to the correction of irregularity. In our text-books and journals there are complicated and labored diagrams and descriptions of appliances, but it is very obvious that "the gigantic intellect does not come to the rescue" in them.

It is the same with fillings. Many operators will put in a simple filling in the crown of a molar and grind down the cusps, and even the enamel ridges, to show off the filling to the best advantage; showing the work in a mirror to the simple-minded patient, who does not realize, until after years, the very serious damage he has sustained.

The idea that continual extraction has no hereditary influence is absurd and ridiculous, though some dentists, in order to convince and console patients for the loss of their teeth, or those of their

children, bring up the old story of the cutting-off of sheep's tails having had no influence upon the length of the lambs' tails at the present day. My experience is that hereditarily contracted jaws are the most difficult to correct of any we have to treat.

During the whole course of my professional life I have only made one mistake in regulating teeth. In that case the patient never developed to normal size; small in stature, diminutive in physique, with large, good teeth in a small mouth, I am free to admit that she would look a little better with that part of her anatomy less prominent.

But look at the thousands of cases at the other extreme. The public are clamorous for deformed mouths! The first demand is to have all the natural teeth extracted and full sets of artificial, little, narrow, white teeth inserted; second choice, about the half of their teeth extracted to improve the appearance of the rest and keep them from decaying; and, thirdly, to have the crowns of the remaining teeth horribly mutilated by filing and grinding. It is a disgrace to the profession that there are so many claiming to be progressive dentists, who accede to such demands and practice to the requirements.

A few months ago the public and a few silly snobs, through the press, went into ecstacies over a great singer's small mouth and beautiful teeth. In reality her mouth was a deformity; teeth irregular, one canine so much out of the arch that when she cast a bewitching smile her lip sometimes caught upon it, and it was with some difficulty she could get it down. Her profile had that sorrowful, dinged-in appearance so common at this day.

Several years ago the papers gave an account of the selection of a characteristic American female head, by the designer of our new silver dollar, that should accurately represent the correct type of American beauty. I do not know the lady, nor her dentist, nor have I had any information with regard to the condition of her teeth or articulation; but, seeing her face upon the few dollars which have passed through my hands, I will venture the assertion that her mouth does not contain thirty-two normally-formed teeth.

In the treatment of cases the great difficulty is to control the patients and parents. In many instances the parents give up long before the child, and say they will have no more to do with it; they would rather see crooked teeth than see their children undergo so much suffering,—nearly all of which suffering was occasioned by changing the application of the apparatus when the teeth were at

their most painful state, for the purpose of cleansing plates or changing direction of force.

Teeth are very easily moved if the force be applied in the right direction, but they as easily return to their old places if the force be too early removed. That is my objection to all of these complicated apparatuses, and is entirely obviated by my system of regulating with screws and levers and rubber ligatures, which are secured to the teeth by thin, annular bands or ligatures of platinum cemented to the teeth with oxyphosphate of zinc, where they remain until the operation is entirely completed. Platinum can be carried between teeth in the most crooked condition, with no more force than would be required to carry a strand of floss silk.

There are no better forces than the old-fashioned screw, lever, and wedge. What we want is the secure application of them, and with this any case can be speedily corrected. In the application of the jack-screw I solder the socket end to an annular band; having selected a tooth in the required position from which to exert force in a right line upon the tooth, I use a similar band, soldering to it a little boss to receive the free end of the jack-screw, which prevents all cutting or other injury to the natural tooth, so that when the appliances are removed the teeth are smooth and uninjured. When I wish to rotate a tooth upon its own axis I use an arm about one-half inch long, with a hook upon the end, soldered to the band projecting from the palatal surface. After the cement is sufficiently hardened, I apply a rubber ligature to any tooth which will exert the force in the right direction. All my fixtures increase the size of the tooth but a mere trifle, and they are tolerated by the tongue with but little inconvenience. I frequently use as many as four jack-screws and several levers in one mouth at the same time. In nearly all cases, if the arches are sufficiently expanded, the teeth will assume their own positions and regulate themselves. Regulation should nearly always be done by expanding the arch, and seldom by contracting.

When a case is completed, I construct a retaining apparatus in a similar manner; securing a bar upon the labial or lingual surface, as the case may require, soldered to platinum ligatures, or bands, which are cemented to the teeth and worn for weeks, months, or years,—if a case should require it,—permitting a perfect cleansing of a tooth upon all surfaces except those parts under the cement, which could not be subject to decay.

DISCUSSIONS ON OPERATIVE DENTISTRY.

Dr. Atkinson: The aphorisms that have been pronounced in the paper just read are, I think, according to nature and truth. There are two or three points with which I do not agree. That the screw should ever be used to move a tooth I do not acknowledge, but that force must be exerted in a direct line is aphoristically true; and a very little force continuously kept up, is sufficient to perform the work. That it should ever require a year to regulate the most refractory set of teeth I hold to be of the past. I have specimens of plates that have been used in which from thirteen days to ten weeks and two days was all the time necessary to accomplish the regulation of teeth in patients over thirty years of age. I feel that there is a dearth of knowledge of the foundation principles upon which the regulation of teeth depends; and the thought of touching a tooth when it is in a condition of tenderness referred to in the paper is so unpleasant to me, that I wish to speak somewhat upon that subject. If you have such an apparatus as will bring the teeth that are not to be moved to bear upon a portion of the apparatus by the antagonizing teeth, you need never have tenderness in those that require to be moved. Constantly irritating a tooth that is in motion is the sole reason of its being tender. The next heresy is this, that we should move a tooth a certain distance by the turning of a screw. One gentleman has said that you can safely move a tooth within twenty-four hours just exactly the two-hundredth part of an inch, and that after that you may turn the screw up again. That is like taking a candle and tapping your shin successively, by which means you will get it sore, but if you hit it with all the combined force of a hundred small taps of the candle you would not bruise it at all. We are now able to accomplish in weeks what used to require months, and in months what used to require years, in regulating the teeth, and when once they are brought into line, all that is necessary to do is to hold them there, and in a majority of cases not even a silk ligature is needed for that purpose.

[The speaker here exhibited plates which had been used to straighten teeth, and explained their use, stating the time required in each case to perform the work.]

Dr. Peirce: With all due deference to Dr. Atkinson's views, I would like to say that while the plates and methods he has described are admirable for the correction of some irregularities, there are many to which they would be wholly inappropriate. So varied are

the cases of irregularity, and the dispositions and peculiarities of patients, that we must adapt our appliances and modes of pressure to the individual case, and not expect to treat all with similar appliances or to obtain uniform results. The application of the screw with its positive pressure in some cases produces admirable results, while in others elastic bands and springing plates, with their gradual and constant tension, serve equally well.

Dr. SHEPARD: I understood Dr. Atkinson to say that one of those plates remained in the mouth from the 30th of May until two weeks ago.

Dr. ATKINSON: About six weeks.

Dr. SHEPARD: How many times was the plate removed for cleansing the teeth?

Dr. ATKINSON: Not at all.

Dr. SHEPARD: Were the same elastics kept on all the time?

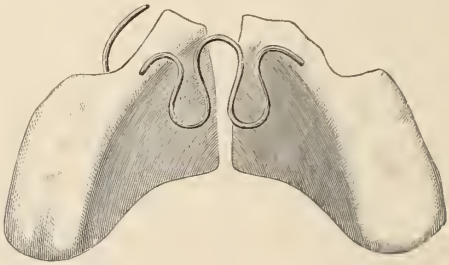
Dr. ATKINSON: The same elastics, except two that broke.

Dr. SHEPARD: In my opinion, as a general rule, an appliance for regulating the teeth which cannot be readily removed by the patient for the purpose of cleanliness, is not a skillful appliance. It seems to me that cleanliness in this matter of regulating the teeth is one of the most important things which we should keep in view. Plates can be made which will accomplish the same that is claimed for those described by Dr. Atkinson, which can be removed after each meal and cleansed and put back by the patient. The principal criticism which I have to make of Kingsley's "Oral Deformities" is that in two hundred pages relating to the regulating of teeth, about three lines are all that there are devoted to the idea that cleanliness in that process is an essential thing. The keeping in of an appliance for two months without cleaning, seems to me to be a very dangerous thing for the teeth and for the health of the soft tissues as well.

Dr. ATKINSON: All that I have to say in regard to that is this, that I pity the perception of cleanliness that needs to remove the plate. The individual who knows what cleanliness is—in the sense of wholesomeness or freeness from foreign bodies—and who understands disinfectants and washes that can be used, need not go any further, and I will pit my patients against any man's for cleanliness of the mouth with the apparatus which I have presented. Those who object to this appliance on this ground do so under a misapprehension.

Dr. MCKELLOPS: This is a subject in which I take very great interest. I was one of the fortunate ones who went across the water

last year, and this method which I saw there is alone worth to me, and I think to the profession, thousands upon thousands of dollars. In my opinion in this small box is contained the apparatus for regulating the teeth, the best adapted in the majority of cases, and for cleanliness and ease to the patient superior to all others. A child can remove it himself. To give an illustration: my little boy, twelve years old, had a plate in his mouth which was made in the city of London by Dr. Coffin. On ship-board, whenever he would get sick and go to vomit, he would take the plate out and put it in his pocket, and afterwards put it in again, and by the time we reached this side of the water—in nine days—the tooth was regulated. I had nothing to do with the apparatus after it was put in the mouth of the child. He did it all himself. I have with me Dr. Coffin's split plate. I saw the models of twenty-five hundred cases. During the time I was having a plate made for my son at Dr. Coffin's, I saw nine cases under treatment. This method is very simple. The whole thing rests upon a little piece of steel piano-wire. The impression of the mouth is taken very accurately, and that is done with gutta-percha. The cup is adapted to the patient's mouth, the gutta-percha taken out of the hot water, placed into the cup and generally dipped into cold water on account of its carrying so much heat, just to chill the surface so that it will not injure the membrane of the mouth. He then puts that into the mouth and lets the child or person bite upon the plate until it comes up thoroughly. The impression is then removed and immediately immersed in a cup of cold water, which causes the gutta-percha to contract to its normal condition as it was in the mouth; thus he gets a very accurate impression of every tooth. The great secret lies in getting a perfect fit of the plate. A plaster model is then made, the wax put upon it, and then



this piece of steel wire is bent into the shape of two S'S and coated with tin; it is then bound together with binding-wire so as to keep

it on the model, and the ends are imbedded in the wax, when it is ready for packing for vulcanizing. After the plate is fitted to the mouth it is sawed in two through the center. The edges are dressed and filed off nicely, and then it is put into the mouth. You will be astonished at the rapidity with which the teeth can be moved by this appliance, and at the slight inconvenience it causes the patient. It is no wonder that the parent gets angry when he sees the child suffering the tortures which many of the plates and jack-screws so much used often occasion. In that case the first thing the child will do is to throw the plate away if he can get at it. In using Dr. Coffin's plate any child can take it out or put it in, just as he pleases. All that is required is skill in making the plate, and although it looks very simple it requires an artist to make one. I understand from my friend, Dr. Shepard, that this appliance has been used in Boston for fifteen years. If they have used it there they have kept it under a bushel. I have been in Boston very often and have never seen anything of it. The first that I saw of it was in London, and to Dr. Coffin all the credit is due. He invented it and has published it to the world, and I tell you it is worthy of the American dentist. He is an American dentist; I have known him for twenty years, and he is yet the same generous, high-toned American he always was.

I wish to relate a case illustrative of the injudicious use of jack-screws. A young lady called upon me for advice, having one of her teeth crowded entirely out of the arch, and turned transversely. I decided that it would be better to take the tooth out, and so stated to her mother, because its loss would not have disfigured her mouth to any extent; but her parents would not consent to that, and so they put the child in the hands of another dentist to regulate the case. He, after trying for some time to regulate the case without taking out any teeth, extracted the bicuspids, when the application of the jack-screw and other appliances was continued, and it was but a short time thereafter until the two front teeth and one lateral were gone, and just before I left home I discovered that from pressure upon the first bicuspid on the left side it had died, and now, from the plate she wears, I think she stands a good chance to have no teeth at all.

[The speaker here illustrated by plates and diagrams the method of Dr. Patrick, of Belleville, Illinois. His remarks in connection with the subject, without the diagram, would be unintelligible to the reader.]

Dr. Noel: I have had a great deal of trouble in locked cases. Two or three years ago Dr. C. R. Taft, of this city, gave me a suggestion that has been of great advantage to me. His method was to make a vulcanized rubber plate that would cover the crowns of the molar and bicuspid teeth, so that the shutting of the lower jaw upon the appliance would drive the plate up into position. With that appliance, by cutting little slots in the plate behind the tooth he wanted to move, and putting in blocks of wood, the swelling of the wood carries the tooth forward rapidly. Such an appliance can be removed at meal time. A few days ago I had a case in which the bicuspid teeth were just erupted, and the molar teeth were so short that I could make no plate that could be held in position firmly enough to get any action on the teeth. There was a central incisor crowded out of the arch. I had used little blocks of wood against the central on the right side, which was in position and against the lateral, crowding it out until I could use no more blocks of wood. It occurred to me to use a block of stationer's rubber a little larger than the block of wood I had wedged in. I passed a silk ligature through the rubber, tying it to the central which was crowded forward, allowing the ends of rubber to act upon the two teeth which I wished to move, and they were carried out in twenty-four hours.

Dr. Shepard: I rise merely to give my indorsement to the Coffin method. Ten years ago Dr. D. M. Clapp, now of Boston, was in the employ of Dr. Coffin, of London, and he brought back to Boston these plates, and during the last ten years they have been used in Boston. Two years ago last May, at the meeting of the Odontological Society, at the house of Dr. N. W. Kingsley, of New York, I exhibited in connection with other things the Coffin plate, and the members of that society to the number of about fifty were present. I have used it extensively during all these years, but never did I appreciate thoroughly its value nor the great variety of cases in which it could be employed, so as almost entirely to supersede all other methods, until in London last summer we had the opportunity of seeing hundreds of plates that had been worn, and the models of mouths that had been treated at the office of Dr. Coffin.

The article of Dr. Walter Coffin has been published extensively in the magazines of Great Britain and in this country, and if any man is a reader of the journals he ought to have read that article, and I trust those who have not will look up the magazines and find the article and read it carefully. Then with the study of the plates, as Dr. McKellops has suggested, he would be able to understand the

matter thoroughly. The credit belongs to Dr. Coffin. A split plate of Dr. J. D. White's is illustrated in Kingsley's "Oral Deformities," but it was an affair of so different construction and upon such different principles, that it does not deserve to be mentioned in connection with the Coffin plate.

I would like to add one or two practical points to what Dr. McKellops has suggested, which might be of advantage. I think he did not mention that before dipping the end of the wire into the melted tin, it was necessary to do as the jeweler who soft-solders always does, dip it into the muriate of zinc preparation, and then the tin adheres perfectly. I have been in the habit of using three sizes of wire instead of one, which enables me to get different strength of spring. I have also been in the habit of dipping my whole spring in tin, so as to get rid of the oxidation of the steel, and it will remain tinned a very long time. There are some mouths in which oxidation is somewhat rapid, but the steel wire generally becomes blackened on the surface, and the oxidation is not of the rough nature that is seen in rough iron and steel. Another important thing in connection with the making of the springs, is to scar or wound the wire as little as possible, making every bend a graceful curve, without any sharp angles, and that requires a good deal of dexterity, and very nicely curved pliers. The practical points involved, I think can hardly be obtained without a demonstration, and I hope that Dr. McKellops will demonstrate the bending of the spring to any member who may feel interested. My main object in rising was to urge upon members to investigate this method and try it, being sure they will be convinced of its great simplicity, efficiency, and value.

Dr. Field: I think I have been fully repaid for my trip across the ocean by the benefit I have derived from this one thing. I have been taught from my childhood up that the sun rises in Boston, but I think the glory of its rising must have been very much darkened by the clouds of ignorance between there and here. It is strange that they have never let us have a little of this light that they have had for the last ten years. I had heard of Coffin plates before, but I had not seen one till I went to Europe, although I have been to two meetings of the American Dental Association in Boston within a few years past. I hope our Boston friends when they again get anything that is as good as this will not allow it to be quietly hid away in their laboratories and offices for another ten years before telling the profession of it.

Dr. Darby: There is one very important point in connection with

this subject that has been omitted. Dr. McKellops did not state, when speaking of capping the molars, the importance of capping all of them. If the first molar be capped and the second not, the latter will elongate, and in a short time thereafter it will be found to have changed its position, thus producing a mal-occlusion of the jaws.

The readiness with which teeth elongate in the mouths of young subjects when from any cause the opposing force is removed, was well illustrated in the mouth of one of my little patients a year or two ago. A girl of fourteen years of age applied for treatment. The incisors of the lower jaw were nearly a half inch behind those of the upper jaw when the mouth was closed, and the molars so short that the lower incisors struck the gum, in which they had made indentations from one-sixteenth to one-eighth of an inch in the mucous membrane. My desire was to elongate the molars, and to accomplish that end, I put into the roof of the mouth a rubber plate, and allowed the lower incisors to strike it, thus leaving a space between the bicuspids and molars. At the expiration of six months I found, much to my satisfaction, that the molars had elongated and were touching again. A thicker plate was substituted, and after being worn another six months, I found the molars had elongated to such an extent that I had more than one-eighth of an inch space between the lower centrals and the gum when the mouth was closed. My next effort was to draw the upper centrals backward, which I did nearly a quarter of an inch. When the teeth were in the desired position, I inserted a rubber crib plate, which capped the molars, and then run as a narrow band around the incisors, touching them high up on the labial surfaces. This plate will be worn at least a year, or until the teeth are firmly fixed in their new positions. It is of the utmost importance that the teeth be held firmly in position until nature has performed her part of the operation.

I heartily indorse all that Dr. McKellops has said in favor of Dr. Coffin's method of using the split plates and piano-forte wire. I was present when Dr. Coffin read his paper and when he showed a half-bushel of plates and models. He certainly gave unmistakable evidence of the success which had attended his efforts in that direction.

Dr. Eames: I want to add a few words in reference to the process of Dr. Patrick. The liability of the displacement of the molar teeth, as in the cases alluded to by the gentleman preceding me, is obviated in this appliance, because we have no cap over any of the

teeth; hence, the articulation of these teeth is not interfered with. The apparatus can be used for different cases by a very ingenious arrangement of thumb-screws; the rings being fitted nicely to the teeth the wire band is slipped through them, and by a thumb-screw on the side the band is shortened or lengthened as desired.

[The doctor continued his remarks, illustrating by the chart the method of adapting the appliance to suit different cases, and concluded as follows:] I will state that I have been using this very successfully for some time. A patient can wear it without any inconvenience. There is no trouble about cleansing the teeth. It can be worn while eating, and with a little instruction much of the adjusting can be done by the patient. I have in many cases used this apparatus very successfully for patients out of the city who could come to me but once a week.

Dr. Butler: Dr. McKellops has described very nicely the method of using the Coffin plate, but I regret that he was unable to state that he has made a sufficiently practical test of this method to be able to give the result in his hands. This subject has been written about and illustrated in the journals by Dr. Farrar, and it is all very nice on paper, but practically it is good only in a limited sense. One set of appliances will not cover all cases. Dr. Atkinson has given some forms of plates that will apply very nicely in some instances, but there are cases in which they will not answer the purpose. This process of Dr. Coffin's I concede to cover more ground than any other mode that has yet been presented to the profession,—I will not except the process of Dr. Patrick—and it is not expensive. With skill displayed in its construction and application, a large variety of cases may be reached. It has another advantage, the fixture can be removed for cleansing in most cases and readjusted by the patient. It is not so difficult to move teeth into proper position as it sometimes is to hold them there until they become fixed; so that the putting on of a retaining splint as described by Dr. Darby, or some equally effective procedure, is quite essential in the majority of cases.

Dr. Eames: I think that of the two appliances that of Dr. Patrick is the simpler, for the reason that you have no plate to make—only the band with its attachments, which may be very simple; an impression is not necessary in many cases. It may be constructed as follows: Select the teeth to which to attach the apparatus, and to them fit closed rings of thin platinum; a piece of clasp-material one-eighth of an inch in width, flat on one side and convex on the other, and long enough to pass around the arch in front of the teeth from

one ring to the one on the opposite side, constitutes the band; solder the ends of the band to the rings; opposite the teeth to be moved, on the outside of the band, solder a small shot of gold, or a short platinum pin with a head, for the attachment of rubber bands or ligatures. This completes the apparatus—all that is needed in many cases, and it can be made and adjusted in one hour's time by any one of ordinary ability.

I understand that Dr. Patrick has made arrangements with The S. S. White Dental Manufacturing Co. for putting this apparatus on the market. When this is done we can keep in our operating-cases an appliance which will aid us greatly in these most trying and perplexing cases of irregularity.

Dr. Dorrance: I doubt not that those present hitherto unfamiliar with this method will attempt its use when opportunity hereafter occurs; therefore I wish to emphasize an important point as yet only hinted at. Those who try the Coffin regulating plate must be cautioned against using too large wire, for they will doubtless be tempted so to do. A very small wire (say, $\frac{25}{1000}$ to $\frac{30}{1000}$ of an inch, or about number 20 to 21 of Brown & Sharpe's plate-gauge in diameter) will accomplish a great deal, with very satisfactory results and little liability to injury, whereas a heavy wire will act so rapidly that severe pain and serious injury are sure to result. Great care should also be observed in opening the spring to increase the pressure, as the expansion will be rapid though a small wire and an apparently slight pressure is used.

I also wish to emphasize the importance of investing all the teeth back of the cuspids with the plate. With the Coffin method, after the arch is spread, any tooth may be moved in or out, or twisted in its socket by means of a simple spring (of the same small piano-wire) imbedded at one end in the plate, and having a direct pulling or pushing bearing, or being attached by hooking into the loop of a ligature well tied to the swell of the tooth.

As the plate may almost invariably be so adjusted as to be readily removed and replaced by the patient with little danger of its proper action being interfered with, this method of regulation has the advantage over every other method in point of cleanliness.

Dr. Keely: In my quiet way, I have done considerable in the line of correcting irregularities of the teeth, during the past quarter of a century; but at no time have I ever imagined that because my apparatus accomplished the work nicely, there was no better way. Over twenty years ago a little miss, aged eight years, came to me

with the superior incisors erupted and locked inside the inferior teeth. For the first time I made a vulcanite plate, covering the permanent and temporary molars and taking a bite. When the plate was finished and adjusted—there was a masticating surface and the teeth raised apart to allow the refractory ones to swing clear in their passage to their normal position—a bar was carried in front of the teeth on which were two little buttons opposite the misplaced teeth; rubber ligatures were placed over the teeth and held by the buttons. This plate was adjusted at 4 o'clock in the evening, and when my little patient called the next morning at 8 o'clock, the teeth were in their normal position. She made no complaint of soreness. The plate was put in again, and the teeth tied to the buttons with No. 40 cotton thread, and the mother shown how to do it. My patient was sent home, and the mother instructed to remove the plate next morning, and put it on every night for a week. It has been said that "teeth once in place, they will remain there." Had I not taken these precautions, as stated, these teeth would have fallen back the first night, for the reason that, as a rule, a child sleeps with the mouth slightly open, and when teeth are moved so rapidly, they must be held in position for a time. In a case like this, I would now make the same kind of a plate, dispensing with the bar in front of the teeth, and making the plate thick on the palatal surface of the misplaced teeth, then cut slots in which I would place sea-tangle tent, which expands gently and will soon force the teeth into place. I would then take No. 40 cotton thread, tie it around the deciduous canine on one side, carry it back of the incisors, and tie to the other canine and leave it there for a week, when the work would be accomplished.

Dr. Morrison condemns the extraction of first molars. I wish to say just here that I do not allow any one to appreciate the value of first molars more than I do. They have a very important part to perform, and do very much in keeping in shape the contour of the face: and under *no circumstances* would I remove one, unless I felt *perfectly satisfied* I was doing the *best possible* thing for my patient. We find many of our little patients, 8 and 9 years of age, with the first molars wholly demoralized, and with our best efforts we can hope to save them only a short time. If the anterior teeth are crowded, I would rarely hesitate to remove the molars; and it should be done prior to the eruption of the second molars, so that they will come forward and take up part of the space made vacant by the first, and, as a rule, they will come squarely up to the second

bicuspid, and look as well as the first molars, and the crowded anterior teeth will fall into line. I only wish I had two or three diagrams here to illustrate this matter from cases in my own practice. A lady, who is now twenty-five years of age, came to me prior to the age of twelve. I found the first inferior molars had been extracted, and the second pretty well erupted. In the superior arch, the anterior teeth were crowded—piled one upon the other. The first molars were decayed, but could have been saved. I did not hesitate to extract them, for it was clearly indicated in this case. I did not see her again for several years, when she came to have some teeth filled. I have a model of this case, taken when she was twenty-five. The superior misplaced teeth fell back, and the second molars came forward bodily, and are squarely up to the second bicuspids in both arches, looking as perfect as any first molars I ever saw. The third molars having ample room are well developed and stand squarely up to the second.

Five years ago a miss of twelve years came to have her inferior molars extracted; the teeth were very much broken down, the pulp dead in one and badly exposed and inflamed in the other. All the anterior teeth were crowded in both arches, the superior canines two-thirds erupted but wholly outside the arch, the laterals and first bicuspids being in contact. Both arches were well developed, and I can only account for this crowded condition from the fact that her deciduous molars were removed before the eruption of the first molars, and when they came, they took up a part or all the space legitimately belonging to the second bicuspids: hence this crowded condition. The superior molars were decayed, but could have been saved. The second molars below were partly erupted and the superior ones just appearing, none of them antagonizing. I made an application to the troublesome inferior molars, and sent the girl home with a note to her mother, telling her what I could do for her daughter if she would put her under my care, and that no fee would be charged. The expressions of appreciation in the mother's answer, and the little miss' saying to a mutual friend that she was preparing herself for a teacher, and that if successful Dr. Keely should be fully remunerated for his services and kindness, paid me better than any other case of regulating I had done. I extracted the first molars at one sitting, and the courage she displayed won my admiration. For a time I waited to see what Dame Nature would do, but I found the second molars were coming forward so rapidly, and taking up the space left by the first, that I wedged the bicuspids back to give

room for the rest of the teeth to fall into line. The teeth are now in good condition,—the canines are in place. A vulcanite plate was worn a few weeks to expand the superior bicuspids a very little to improve the contour of a beautiful face. The second molars are very nearly in contact with the second bicuspids and have come forward with no indication of tipping. Had it been possible to save the inferior molars permanently, both arches could have been expanded and the teeth brought into line.

Dr. Peirce: Where economy in time and simplicity in appliances are desirable, I have found that where lateral incisors—one or both—were encroaching upon the palatal surface and striking within the inferior teeth, a most admirable and prompt method of correcting them was to drill upon the palatal face, just below the cutting edge of the tooth, a small hole, and also upon the first molar of the opposing side a similar hole, just at the margin of the gums; then procure a strip of heavy platinized gold plate, in width about one-fourth inch, and in length sufficient to bend to the outline of the palatine arch and be out of the way of the tongue, and with the end sharpened to a point, to spring with some force into the holes in the opposing teeth. The elasticity of the plate so bent, will be found to be sufficient to press the lateral forward into position, where room has been previously gained. This appliance has the advantage of pressing only upon the teeth, producing no irritation of the gums, and of being of comparatively little inconvenience to the patient; while the plate can be made and adjusted without taking an impression or making a cast. The work and result are promptly accomplished and the small holes in the teeth are readily filled, so that the teeth suffer no disadvantage from them. The same appliance can be used to press forward the central incisors as well as the laterals, and by a little careful adjustment of the plate, the two laterals or the two centrals at the same time.

Dr. Keely: I spoke of the benefit I had conferred on my little patient by removing the first molars. I wish to refer to another benefit, conferred every time it is necessary to remove first molars before the eruption of the second. The second molar will come forward and give ample room for the eruption of the third. The life of this latter tooth in a majority of cases is crushed out for want of space, and we are all too prone to consider it of little or no account. Give a third molar ample room to develop, and you will find it as good as the second. This you will find is true, nineteen times out of twenty.

When in Chicago, recently, I saw a case of irregularity, which I hope Dr. Crouse will explain.

Dr. Crouse: I have had one extreme case, the models of which I am sorry I have not here, as they would illustrate what can be done in the mouth of a young man twenty-one years of age. When he came to me the position of the upper teeth was such that by the force of mastication the under back teeth were driven toward the tongue, constantly narrowing the circle in the lower teeth so that there was not room below for his tongue, and he could not talk in a voice to be understood, the lower front teeth protruding beyond the upper. He had been tinkered at by some inexperienced parties for five or six years. I had first to move the upper teeth; and I do not think I exaggerate when I say the back teeth were moved apart an inch, which just gave room for the teeth to come into proper line in the arch. The patient was a young man of large physique. The work was accomplished entirely with rubber plates and jack-screws, but I had to apply two jack-screws. He would break the screws every few days with the force applied. It was a year before I dismissed the case. I first enlarged the upper arch and held it in place, and then proceeded with the lower. Now the teeth are all in position.

The young man continued to follow his employment and was very little inconvenienced. He did the work himself while I did the advising. I do not see how any thing could have worked better in this case than rubber plates with jack-screws vulcanized in them, and the plate cut in two.

Dr. Marcklein: Judging from the appliances exhibited and the remarks made on the subject, it seems to me that they all are very efficient so far as expansion is concerned. I would like to ask Dr. McKellops if they are as applicable for drawing teeth backwards? It has always been with me a very easy matter to throw teeth forward, but it has been very difficult to throw them backwards. I have used all appliances in regulating teeth, and I don't think any one of them will answer all cases. I have one case of a young lady sixteen years old, whose upper teeth project just one-half inch beyond her lower ones, giving her a very unpleasant expression. Her first upper molars are lost and the second are sound and in their place. I would like to know what appliance would be best to draw those ten upper permanent teeth so as to get them in their proper place.

Dr. McKellops: Here is a plate for that very purpose. I do not claim that every thing can be done with one plate. There must be a variety of plates, and the skill of the operator comes in play here

to enable him to get his bearings right and to bend the wire so that the pressure is exerted in the right direction.

Dr. Marcklein: The only anchorage that I can see that we can have in a case such as I have mentioned, must be furnished by the two superior second molars. The other teeth must all be thrown or drawn backwards, and I would like to know if the anchorage on those two teeth will be sufficient to make it possible to throw back all the other teeth. My experience has been that the molars come forward a great deal easier than the others come backward. I can readily see the value of this appliance in the case of one or two teeth, or even four, but here we have an extreme case of ten teeth to be moved, with only two upon which to anchor.

Dr. Thomas: Move one at a time.

Dr. Morrison: Dr. McKellops, as long ago as 1865, brought the original Coffin plate from Europe. It was a rubber plate with caps for the molars merely. I have used those plates under Dr. McKellops's order and directions, as I was associated with him at that time and was doing that kind of work particularly. They are very good plates for some cases where the molars are large and you can get good anchorage, but where the teeth are small, with short crowns, they are of no account at all. In the latter class of cases the shape of the teeth is such that if you do not tie the plate with ligatures up above the swell of the tooth, it will slip off. If you tie it above the swell you are obliged to cut into the healthy soft tissues an eighth of an inch.

I offered you this morning an entire substitute for all such inconvenience as this. I said at the outset in my article that these old bungling things ought to be things of the past. I offered you something which can be adjusted at the swell of the tooth. There is not a gentleman who has made a remark that bears upon the point last referred to, since the discussion was opened.

SECTION VI.

Pathology, Therapeutics, and Materia Medica.

The Possibilities in the Treatment of Pulpless Teeth.

Paper by A. O. Rawls, of the Section.

In pulpless teeth there are two tissues more or less intact and devoid of life, viz., the enamel and the dentine; two tissues still existing,—one with a possibility of but very slight break in its nutritive continuity, viz., the pericementum, the other with the probability of numerous breaks in its channels of life, viz., the cementum. In the case of alveolar abscess the same tissues, as above, are usually involved in the same manner, and to the same degree, but there are exceptional cases in which this does not take place. These latter cases are those wherein the abscess does not cause destructive lesions at the apex, or apices, of roots of teeth; as when it occurs at the point of bifurcation of roots, upon the sides of roots, etc. Aside from the conditions mentioned, alveolar abscess may involve, in addition to the above, more or less loss of the periosteum and process in the vicinity of its attack, thus leaving the process in proximity to the abscess either partially or completely denuded of its proper covering. In all pulpless teeth, whether the condition is complicated with alveolar abscess or not, there is, of necessity, a break in the nutritive continuity at the ends of their roots. In all cases of alveolar abscess there exists a similar condition in which the nutritive supply is cut off, either from the cementum or the process, at the point of attack.

I believe it is the generally-accepted opinion that there is but one periosteal membrane between process and tooth; also that this membrane is attached to both process and cementum by minute shred-like prolongations or ramifications of its connective tissue, together with nutrient vessels passing into and out of its substance. This being true, any inflammatory action may, according to the location of its cause, result in an abscess which will destroy the connection either between the process and the membrane, or the cementum and mem-

brane, and may ultimately involve an entire dissolution of more or less of the membrane at the seat of disease. It is to the latter probabilities that we may ascribe the differences of opinion relative to the question as to whether all conditions of this character are abscesses or ulcers, or some are abscesses and others ulcers.

An alveolar abscess which has for its cause a dead pulp generally presents, at some period of its existence, that condition known as a dentigerous cyst or sac. When occurring upon the sides of a root, or in the bifurcation of roots of teeth, it may have the same cyst-like character, but it oftener partakes of the character of an open or superficial ulcer. If the inflammatory process causes a separation of the pericementum from the cementum, but leaves the membrane more or less perfectly attached to the process, the sac-like condition will most likely for a time prevail. On the other hand, however, should the attachments first be broken between the process and the membrane, a cyst or sac is not likely to be formed, but, as is more or less frequently the case, the membrane will rapidly melt away and the lesion will present all the characteristics of an ulcerated surface. The physical differences therein are as follows: In the one case we have an open ulcer, with no specially-defined limit or line of action, while in the other we have a more or less closed ulcer, with a more definite demarkation between healthy and diseased tissue. So far as these physical aspects are concerned in the breaking-down of tissue, they probably amount to the same, all things else being equal; but their effects toward assisting or retarding the reparative process would seem to be at variance.

Now let us recur to the subject proper. You are aware that success in the estimation of some practitioners is not success in the opinion of others. The principal questions here involved are, by what standard do we measure success? and by what should it be measured? I anticipate the answer of some of my confrères by stating that the standard should be the length of time teeth so treated may be comfortably retained in the mouth. I also anticipate the answer of others by adding to the statement, "and be of service to the patient without detriment to surrounding tissue." My comment on such answers is that they simply imply varying degrees of success in conformity with the toleration of lesions present, by the endurance of the patient or integrity of the part involved. It is of common note that dentists speak of the cure of these cases as though it were absolutely perfect, and similar to the cure of a cut or wound in any external soft tissue. If this is true, *i.e.*, if the lesion is healed in a

physiological manner, after that of healing in other tissues, it must be in one of two ways, viz., 1st, by a complete restoration of lost periosteum or process, or both, to and in their normal condition; or, 2d, by the formation of what may be termed false tissue, which, not being normally nutrified, is much more likely to be broken down.

Let us begin examination by taking for our first case a superior central incisor in which the dead pulp has been separated from the living tissues at the apex of the root by a physiological process. All practitioners will admit the comparative simplicity of such a lesion, and, with myself, acknowledge that if a perfect restoration of at least the periosteum involved can take place about the roots of any teeth so involved it certainly can in a case of the character above mentioned.

Prosecuting an examination into the physical, chemico-physical, and physiological conditions likely to be present in such a case necessarily exacts inquiry in several directions. First of all, the question as to whether the root-membrane in health has any connection with the vessels and tissue passing into the nerve-canal at the apex of the root must be settled. If it has not, then, in case of death of the pulp there is no break in its continuity at this point, save by contact and possible irritation of dead tissue of the pulp or other foreign substances. If a connection does herein exist, then death of the pulp breaks it, and conservative treatment will, in so far as this lesion is concerned, be successful in proportion to the degree of re-establishment of nutrient circulation at the point broken.

For the present, however, let us admit the truth of the former condition, viz., that there is no connection between these two tissues at or near the end of the root. It will be much easier for us to argue complete success from such a stand-point.

So much, then, being admitted, we have, in the case under consideration, a simple disconnection, at the apex of the root, of tissues once passing through to nutrify the dentine and other parts of the tooth. This break has been healed by a separation of the dead from the living tissue in a physiological manner. Now, this would seem to indicate complete success in an endeavor to save the tooth, and no doubt, if such a result be possible, it can be attained in this case, by a careful and thoughtful manipulator. But even here we necessarily contend with the possibility, aye, probability, of inorganic or disorganized organic irritants which may remain in contact with vitalized tissue at the end of the tooth after removal of the pulp. Aside from this, in the operation of filling the root-canal, we are

brought face to face with two difficulties, viz., that of securing a filling-material compatible with the healthy tissue whose border it should barely, yet actually, touch, and that of placing such material in such position that it would not impinge upon or be distant from this tissue. And yet these are not all of the influences operating against complete and lasting success in the conservation of such teeth. On the contrary, we must admit, even though there be (normally) no continuity of nutrition between dentine and cementum, that an animal substance like the dentine cannot, when deprived of vitalizing sustenance, remain continuously in juxtaposition with living tissue without affecting the integrity of such living tissue in a greater or less degree.

This case, of which I have endeavored to present the characteristics somewhat in detail, is, as you may readily see, one of those most favorable for treatment looking to successful results. Indeed, such teeth, presenting the conditions enumerated in the foregoing pages, are so often saved in usefulness to the patient for a number of years, without apparent detriment to or loss of surrounding tissue, that it would seem like making mountains out of molehills to even mention their characteristics. Nevertheless, the same underlying principles herein exist to modify success as are present to bar its probability in similar though more extensive lesions, the difference being only a matter of degree rather than character of conditions present.

Now, let us instance another case wherein exist similar diseased conditions, but presenting more extensive disruption of tissue. You have observed in practice (for I think such conditions common, even in a limited practice) that at times there is a denuding of the root-membrane about the immediate end of the root, consequent, at least, upon continued contact of dead, disintegrating, or suppurating tissue. To exemplify, we will take for example an inferior incisor or cuspid tooth, the shape of the root not exactly common to such teeth as a class, and yet very often met with, viz., one with the root flattened laterally, and thus comparatively thin from side to side; the dead pulp has been removed, the root is denuded of its proper covering for, say, an eighth of an inch from its foramen, and the remaining membrane thickened and irritated to the degree of cell-proliferation for at least an eighth of an inch further toward the crown, and if the membrane is continuous from the point of separation from the root with the process round about the lesion it may be, and probably will be, inflamed to the extent of its separation.

However, we may have in such cases a complete destruction of the membrane beneath the end of the root to a point diagonally downward from its point of contact with the root. This relative position of attachment to root and process is due principally to the operation of physical laws. In either event, *i.e.*, whether the periosteum maintains its attachment to the process beneath the end of the root, or, on the other hand, is melted away, you will certainly bear me out in the statement that to secure a perfectly successful re-establishment of, first, contact of periosteum with the part from which it is broken, it is necessary in one instance that there be a gradual development of the process from beneath the periosteum, or a thickening of the latter until its apposition is normally complete with the surface of the cementum; and in the other case, *i.e.*, where the membrane is entirely destroyed beneath the end of the root, that this development of either periosteum, or process and periosteum, take place from the points of attachment to root and process downward and inward toward the apex of the root involved.

This admitted, allow me to call your attention to the fact that still another difficulty, of much graver aspect, must be overcome before the nutrient current between the cementum on the end of the root and the periosteal source of supply can again be normal to the part. I refer to the difficulty of a formerly organized—though now disorganized—tissue again accepting a physiological union with the newly-developed membrane, and by such union re-establishing organization out of non-affinitative and, indeed, we might say, entirely foreign substances.

Now, if it be true that in these most favorable cases there exists such opposition to the return of the parts to normality, such definite and destructive character of forces to be harmonized ere success can be perfect, I ask you what must be expected in cases of alveolar abscess of long standing, in which we would labor to conserve the organ or organs at whose root or roots the lesion is most extensive? I ask you, Gentlemen of this the representative body of our calling in this country, are we not presuming too much at the hands of the *so-called mysterious vis-vitæ*, and reckoning too little of the chemical, the physical, or chemico-physical possibilities in the treatment of these cases?

SECTION VI.—Continued.

Diatheses and Cachexiæ.

PAPER BY F. M. ODELL, CHAIRMAN OF THE SECTION.

IN the diagnosis and treatment of the various ailments to which we are liable, it has always seemed to me, that however beautifully the practitioner may have been in the habit of lecturing or writing, he not only in his practice often falls far short of carrying out the line of therapeusis that might be expected of him, but absolutely fails to *perceive* anything beyond or preceding the most prominent symptoms and "physical signs." Indeed, one of our well-known writers replied to me, in speaking of diabetes, "No one has a tendency towards diabetes; you have it, or you don't have it, and that's all about it! You cannot have a *tendency* that way."

With all due deference to that gentleman, in consideration of his superior age and greater practical experience, I must hold to my preconceived opinion that not only can one have a tendency that way, but that the time is not far distant when medicine must follow in the footsteps of her younger sister, dentistry, and devote the energies of her ablest sons, not as now, principally to the observation and treatment of symptoms, (thus permitting these sons aforesaid to supinely fold their hands while the fell powers of disintegration and darkness carry us rapidly down to an untimely grave), but to the unraveling of that chain of personal or family history underlying and far anterior to these present and conspicuous manifestations; and by personal or family history I do not wish to be understood as intimating that the practitioner should busy himself with the past history of the patient or his progenitors, as individuals, as to whether they lived here or there, well or ill, married or divorced much or little, or with any matters having within themselves more of the elements of gossip and scandal than of scientific research after truth to aid him in a proper estimation of the case under observation, but simply that he should make a proper use of those God-given faculties, which, incited by his course of preparatory studies, strengthened by his practical or clinical training and experience, and directed

by a painstaking desire to use whatever he may possess of judgment in the interests of his patient, shall enable him to not only note evident symptoms and physical signs, so called, but commencing with them as the initial step, to work his way back in those processes of molecular metamorphosis whereby he can deduce not only the inciting causes of the pathological condition before him, but the remote cause or causes which made this pathological condition a possibility. In other words, that medicine must adopt much more of prophylaxis, based upon scientific inquiry, before her disciples can afford to sneer at our efforts in a more circumscribed sphere of usefulness.

Some few of our medical practitioners loom up above the vast majority, and not only pursue successfully an exacting calling, but find time to reason and write upon the subjects of their daily observation and thought; but the vast majority figuratively exclaim with a fellow-student of mine when, the clinical professor having led us up to a diagnosis, and he (the student) having named the malady brought before us for treatment, "At last I am a physician! Now I can practice!" And having reached this sublime altitude, they immediately consider that having learned the trade, they can now sleep upon the field of battle; in the future it is only necessary to follow the regular formulæ, and success is assured;—and to many, unfortunately, so it is; for if the medical pretender be a person of good address, or belongs to the proper congregation, or has the requisite amount of unblushing effrontery, he can generally find more who are willing to be dosed by him for prominent symptoms than his more diligent but less dashing co-laborer can, of those who are willing to be treated upon rational principles.

And this brings me to the underlying thought of my present inspiration, viz: the subjects of diatheses and cachexiæ. To go into an exhaustive dissertation upon these points would only be to wear out what little patience you have left, and, perhaps, to open an endless and partially profitless discussion; because, among medical writers and speakers, I find the most diverse opinions and assertions in regard to what should be classed as diatheses, and what cachexiæ; but in general terms I would simply designate diathesis as that weakness or tendency towards disease which is entailed by the law of heredity, and cachexia, as that tendency in the same direction, arising by reason of the circumstances of environment, habit, or experience of the individual.

Authorities (?) differ as to the number and nomination of either; and the innumerable instances of diatheses being crossed in the same

individual, render their pronouncement somewhat difficult at times; but the certainty remains, that the practitioner who has so well studied the physiognomy of disease as to clearly perceive the particular diatheses which he has to deal with, has enabled himself to stand upon the same, or even a higher plane of usefulness than does the old family attendant who has been present at the advent of the patient into this world of trials and tribulation, and has had him under supervision ever since.

In order that you may not accuse me of talking medicine, and ignoring dentistry in these remarks, I will refer to a matter which is particularly within our province, and endeavor to show that we cannot practice as simple mechanics any more than can the regular medical practitioner, without at once giving up all our boasted claims to be considered men of scientific attainment.

In a recent case of recession of the gum, with soreness, dropping of the tooth from its socket, occasional slight points of ulceration, rapidly followed by loss of tissue, little evidence of pus, after cleansing perfectly from tartar, and painting at the extreme limit of contact of gum and tooth, with aromatic sulphuric acid, I found the case growing no better very fast; the neck of the tooth at one side becoming exposed much further towards the apex, and the soreness becoming so intense as to seriously threaten the loss of the organ through the impatience of the patient, I took the patient's measure somewhat more carefully, and concluded that local treatment would be more successful if supplemented by iodide of potash, or a little mercury; and I found that such was the fact when I merely used palliative treatment for the gum, and administered co. cath. pill, with cod-liver oil and tonics, varying the latter every third day in order to better conserve an exceedingly capricious appetite. Result:—in a week, great improvement in hopefulness, etc., and much better condition of gum; attachment having taken place again one-third the length of the tooth below the apex of the root; but with greater hopefulness came less docility, and for three weeks I saw nothing of the patient; then he presented himself with the gum all gone again, notwithstanding his having been very careful to keep it cleansed, syringing three or four times daily with a very weak solution of phénol sodique. A return to aromatic sulphuric for local treatment only made matters much worse, and the hot weather being against us also, I suspended further operations in that direction, and commenced again on iron and quinia in pill, and locally simply washing with weak solution of chlorate of potash. And in this connection

I will mention a dressing for ulcers which is easy of application, and very pleasing in its action. It is to simply drop a little mat of cotton upon the surface of glycerin, and then reversing the cotton, dust over the surface of the glycerin which adheres to it a little salicylic acid, or a little salicylate of soda. Both act well, and are very soothing in their effects.

Another case presenting lately, I did not treat locally at all; because, from the evident rapid retrogression in metamorphosis of tissues in that vicinity, the bony socket having entirely subsided from one tooth, pulp dead, and the triumphal arch of little pustules covering one-third of each adjoining tooth, combined with the little, blinking red eyes of the patient, and their tumefied lids, and the evident eagerness of their possessor to pay very liberally for relief, I at once relegated the tooth to the forceps, and the case to the domain of the cachexiæ; believing that the regular family practitioner could best meet the indications.

The first-mentioned case I divided for treatment between a diathesis and a cachexia; the former being responsible for the mercurial, the latter for the tonic.

Of late I have involuntarily become much interested in the study and observation of gout in its various manifestations; and without in the least drawing upon imagination, can see the very close relationship existing between gout, rheumatism, hay-fever, rose-cold, diabetes, Bright's disease, and a host of complications under as many different nominations, which all tend in the same general direction, but which in their effect upon the general system, may be compared to the value of stock in one of our great arteries of commerce, which is profoundly impressed, as a whole, if a fluctuation of any magnitude is felt in one of its branches.

It is all very well, nay, sometimes imperative to adapt the treatment to the mitigation of the prominent symptoms, but in order to a radical cure the diathesis must be determined, and a few blows struck in that direction fall with telling effect upon the sequelæ.

In hay-fever, for example, *i.e.*, in true hay-fever, the inciting cause of the temporary disturbance, we may, for argument's sake, admit to be the titillation upon the end organs of the nerves of smell induced by the pollen of plants; but this particular inciting cause being removed, any new irritation of the same peripheral nerves—from the dust of a room or road to the exhalations from an onion or a piece of cheese—serves to perpetuate the impression for days and weeks, until, in some instances, it becomes a chronic habit or cachexia, and

is no longer dependent upon times and seasons. For the immediate relief of the early symptoms, a little vapor of cubebs or saltpetre, or a weak solution of salicylic acid or borax, may serve the purpose, but for a cure, a treatment of the diathesis best answers. If the diathesis be of gout, I have great faith in salicylate of potash; if of scrofula, some form of mercury would do good, while salicylate would be wasted time and material.

And speaking of salicylate of potash, I have very little faith in its ability to reduce temperature, but the fever accompanying this condition is very readily controlled by a combination of the salicylate with sulph. quin.

And here again we see an evidence of the justice of some of the principles of Homœopathic practice, viz., that a treatment which will certainly subdue a fever arising from one cause, is with modifications good treatment in all other fevers.

In this connection I cannot too highly recommend the use of water internally and externally, varied from ice-water to hot water, according to the indications, for all conditions, whether pathological or physiological.

In hay-fever, one of the most intolerable symptoms is a burning or itching sensation at various points of the body, notably at the inside of the calves of the legs. This is either entirely relieved, or rendered nearly imperceptible in a very few minutes by a hot bath, followed by a solution of borax in water, or water and alcohol; and free perspiration, without being excessive, is maintained by indulging at the same time in plentiful libations of either ice-water or hot tea, as the appetite may crave. The chief difficulty to be provided against afterward, is sudden reduction of surface temperature, and this end is excellently well served by some newly-put-upon-the-market underwear, viz., that made of a large sized net-work, similar to a fish net, which by its large meshes enables a considerable layer of air to officiate between the skin and the clothing, as a gradual medium of exchange of temperature between the body and the external atmosphere. Thus, by a simple mechanical contrivance, we can materially assist in the conservation of body-heat in winter, and the gradual dispersion of the same in summer.

This contrivance, which feels excellent, and makes a splendid appearance, I regard as of great interest to all, for the greater part of our ailments are the result of our carelessness in this regard, either arising from our ignorance or from circumstances beyond our control whereby we fail to regulate somatic heat-production or heat dispersion.

SECTION VI.—Continued.

Hydrogen Dioxide.

PAPER BY A. W. HARLAN, OF THE SECTION.

WHEN the treatment of alveolar abscess was under discussion before the Section on Diseases of the Teeth in the International Medical Congress, last summer, Mr. Walter H. Coffin, of London, spoke of the use of hydrogen dioxide, and of its efficiency in those cases where no fistulous opening was established, mentioning casually that by injecting the sac with this new agent it could be easily evacuated without coagulation of the contents or clogging the canals at the apices. After some ten months' quite constant use of this remedy, I am induced to present a few observations on the preparation of $H_2 O_2$, and the mode of using it.

As it is not always possible to obtain hydrogen dioxide of sufficient strength to be useful, the following is offered to enable those who may so desire to prepare it for themselves: To prepare hydrogen dioxide small portions of purified moist barium dioxide (binoxide of barium) are gradually added to a cold mixture of one part of sulphuric acid and five parts of distilled water, taking care to prevent the temperature from rising beyond 68° F., and suspending the addition when the liquid has only a slightly-acid reaction. The precipitated sulphate of barium is allowed to deposit, and the liquid is filtered off. It is best to retain the slight excess of sulphuric acid, since the compound keeps better when this is done. The solution thus obtained, which scarcely ever contains over five per cent. of hydrogen dioxide, may be concentrated either by exposing it *in vacuo* over sulphuric acid at a temperature of 59° to 68° F., or it may be exposed to cold and frozen, and the frozen portion removed. The residuary liquid by the latter process will be much more concentrated than that by the former, as hydrogen dioxide does not freeze even at —30° F. If the solution is allowed to evaporate over sulphuric acid, it may happen that bubbles of oxygen will begin to be given off. In this case, the addition of a few drops of sulphuric acid will arrest further decomposition.

The aqueous solution, if not too strong, can be preserved for months if it is kept in a cold place, not exposed to light. Hydrogen dioxide is easily soluble in ether. If the aqueous solution is shaken with ether, the latter dissolves out the dioxide. The ethereal solution is much more stable than the aqueous, and may even be distilled without decomposition. An easy test for determining the quantity of hydrogen dioxide present in any aqueous solution may be made by strongly acidulating the liquid with sulphuric acid, and adding from a burette a solution of potassium permanganate of known strength until the purple tint of the latter is no longer destroyed. In this case the following reaction takes place:

$$\underset{\text{Potassium Permang.}}{K_2 Mn_2 O_8} + \underset{\text{Sulphuric Acid.}}{3H_2 S O_4} + \underset{\text{Hyd. Diox.}}{H_2 O_2} -$$

$$\underset{\text{Potas. Sulphate.}}{K_2 S O_4} + \underset{\text{Mang. Sulphate.}}{2Mn S O_4} + \underset{\text{Water.}}{4H_2 O} + \underset{\text{Oxygen.}}{3O_2}$$

Each gram of potassium permanganate used corresponds to 0·108 gram of hydrogen dioxide.

During the past year, in general medicine, renewed attention has been drawn to this agent, and the most extraordinary curative effects have been attributed to it, with what propriety the future will show. It is, for instance, stated that "no physician who has only once tried hydrogen dioxide applied in spray to suppurating eyes or suppurating wounds will ever want to be without it." "Passing a few times across a sick chamber while projecting a spray of a two-per-cent. solution renders the air odorless and pure," etc. To show its antiseptic properties, Guttman mixed nine parts of urine with one part of dioxide and allowed it to remain nine months, and it did not putrefy. MM. Béchamp and Paul Bert have, by a series of experiments, discovered that oxidized water arrests fermentation from the presence of living organisms, but is inert in the presence of amorphous ferments, such as diastase, saliva, pancreatic juice, etc. As it is not improbable that the compound will be more frequently experimented with than before these later investigations, some statements contained in a recent circular of H. Trommsdorf, the well-known manufacturer of chemicals at Erfurt, Germany, will be of interest. He says: "It is occasionally stated that distilled water can contain 'ten volumes of hydrogen dioxide;' this is wrong, and is due to an erroneous conception of the words 'ten volumes' which is attached to the quotation of the article in the price-lists. Hydrogen dioxide in its pure state is a *liquid*, and not a gas, and the

'ten volumes' is meant to convey that the product contains ten volumes of available oxygen,—or, in other words, one measure of the commercial liquid can give off ten measures of oxygen. This corresponds to a three-per-cent. solution of hydrogen dioxide. A 'two-volume' solution would be one which gives off twice its volume of oxygen,—or which contains 0·6 per cent. of $H_2 O_2$. Most of the peroxide of hydrogen in the market is little more than a solution of commercial barium dioxide in dilute hydrochloric acid, and possessing but feeble keeping qualities." At present Trommsdorf's product contains three per cent., or varies but a trifle from that figure. It must be kept in a cold, dark place, in glass-stoppered bottles, which should be small if the consumption of the article is insignificant.

I have always used the aqueous solution in the treatment of blind alveolar abscesses and *pyorrhœa alveolaris*, as I have found the rapid evolution of the oxygen to effect a thorough evacuation of the pus. One may see the thin, frothy contents of a non-fistulous abscess—even though the tooth is in the lower maxilla—gradually escape from the sac beneath, if this agent is thoroughly applied. Hydrogen dioxide is such an unstable compound that it immediately decomposes when exposed to the air or is brought into contact with the contents of the sac, liberating oxygen, which unites with the pus and causes it to escape. The unsatisfied molecules of oxygen mechanically distend the sac, thus forcing the pus from it, and thereby causing its complete evacuation. Such an agent must commend itself to any one for the simplicity of its working, as a ready and efficient means of accomplishing so difficult an undertaking as the removal of pus from around the apex of a lower cuspid or bicuspid, without creating any unpleasant after-effect. In practice, after opening the canal, I at first very gently wash out the canal from whence the pus is oozing, and afterward carefully inject the remedy into the sac, which is immediately distended by the evolution of oxygen, and the complete evacuation of its contents follows. I then introduce strands of cotton saturated with volatile eucalyptus, and lightly seal the cavity. The dressing is to be changed in three days, when, if there is no pus or odor, the canal is to be packed tightly with cotton moistened as before, and sealed with gutta-percha. In a week or ten days the root may be filled, leaving the cavity of decay to be filled when convenient. In some cases it may be necessary to use hydrogen dioxide two or three times, at intervals of three or four days, in order to arrest the production of pus. It is always neces-

sary to adjust the rubber dam over the tooth while treating it or changing the dressing. I prefer the volatile eucalyptus as the after-dressing, on account of its not being escharotic or irritating to such a surface as is presented after the use of $H_2 O_2$.

These brief observations are not offered for the purpose of discouraging the so-called "radical" treatment of latent abscesses connected with teeth, but to place in the hands of careful and delicate manipulators a remedy which will prevent much suffering to the patient, if used intelligently. I venture to suggest that $H_2 O_2$ may become useful as a bleaching agent for discolored teeth, as it is now largely used in the arts for bleaching; but, so far, I have not tried it for that purpose. Other uses of this new agent will, doubtless, suggest themselves,—a remedy which, I hope, is to become a valuable addition to our too slender list of efficient therapeutical agents.

DISCUSSIONS.

Prof. Mayr: One of the sentences of Dr. Rawls's paper was, "are we not presuming too much on the *vis vitæ* and recognizing too little the chemical forces in our treatment of such cases." I have heard the expression *vis vitæ* used very frequently, but not a person thus using it has been able to give me an acceptable definition. Before I can say any thing about it I would like to hear Dr. Rawls's definition of it.

Dr. Rawls: *Vis vitæ* is my idea of what is generally called a force which we know not of, a force which is mysterious and intangible, which is referred to as the force of life separate and apart from physical, chemical, or chemico-physical action.

Prof. Mayr: It is in my opinion nothing but an empty word, and whenever I hear the expression "*vis vitæ*," I like to know the exact component of the *vis vitæ* which is referred to. For instance, it is said that "vital force" unites by first intention the two surfaces of a recent wound. That is an expression in my opinion that ought not to be used in our scientific century. There is something definite which acts to unite them. How are those surfaces united? We find that proliferation takes place, but what produces this? The only scientific answer is, I do not know; for we cannot go further without using an empty word, which does nothing but blur our minds and impede our progress. I now understand the gentleman perfectly well, but I thought perhaps he had a peculiar idea that I would have liked to get the definition of.

A year ago in the meeting of the Connecticut Valley Dental Association, I spoke of hydrogen peroxide and suggested that it might be used for bleaching teeth, but there were so many opinions as to how it should be used that no agreement could be arrived at about the manner of its application. It was thought it might be sealed into the cavity of the dead tooth and then slowly allowed to ooze out, but the objection to that method is that oxygen is disengaged so rapidly that it would finally burst the tooth. Then it was suggested that it might be applied by painting on the outside of the tooth two or three times daily, but the question arose, will the hydrogen peroxide go through the enamel? The enamel, according to the latest investigations, has fine openings. It is a finely-organized structure, and is capable of allowing fluids to percolate by endosmosis and exosmosis, but in all probability this circulation would be so sluggish that it would bleach the teeth too slowly to be of practical value. The cause of the discoloration of the teeth is a disputed point. I have tried in vain to inform myself about it from the journals, etc. The necessity of scientific investigations becomes very apparent when we attempt to discuss this subject.

We cannot intelligently proceed to bleach a tooth before we know what has discolored it. That is something for the investigator in histology to settle. I myself am unable to give an exact opinion. I have only the supposition that the tooth is discolored by a hematin-like substance of the red blood-corpuscles under some form. If we knew in what form the hematin existed in the tooth we could give the exact substance to bleach it. The antiseptic properties of hydrogen peroxide are not due to oxygen, but to ozone. About six years ago a gentleman in Berlin prepared ozonized water by allowing air passing over moist phosphorus to bubble through water. A small quantity of ozone, which is always generated when phosphorus is in contact with moist air, was dissolved in the water in this way. This ozonized water was antiseptic and excellent for the treatment of wounds.

Dr. Ingersoll: I wish to bring to the attention of the profession an ulcerative process beginning at the apex and reaching to the neck of the tooth, arising from another cause than that of salivary calculus. I assume this to be a fact:—that no pulp dies a spontaneous death without causing disease in the peridental membrane. The forms of disease which may follow are various; it may be chronic inflammation of the peridental membrane; it may be tumefaction of the membrane; it may be a permanent induration of the sur-

rounding parts; it may be alveolar abscess, or it may be alveolar ulceration. We often hear the profession speak of ulcerated teeth —using the term synonymously with abscess. I think that very little distinction has ever been made by the profession between these two terms as applied to the formation of pus about the apical portion of the root. I thought that I had arrived at a very satisfactory treatment of abscess, yet I found cases supposed to be abscess and treated as such, in which my treatment failed; and I did not understand why I failed. But on more careful study of my failures, it dawned upon me that these cases presented a form of disease that is not alveolar abscess, but alveolar ulceration—having none of the characteristics of alveolar abscess, except that of a pus discharge, yet differing from *pyorrhœa alveolaris.* There was no circumscribed pus-cavity; no formation of a tubular canal running out from the pus-cavity to the surface; no thick ichorous pus, but a thin, watery fluid, and no tendency to swell. I therefore said, this is not abscess, but something else. About this time I extracted a tooth, in the treatment of which I had failed, and I found covering one quarter of an inch of the apical end, a hard, firm incrustation, unlike any salivary calculus, of a very dark color, and much harder than any salivary calculus I had ever seen, and in appearance granular. The inquiry that first came into my mind was, how could saliva reach this point to deposit its lime-salts? The gum was firmly adherent to the neck of the tooth, except at a single point where a lip of gum acted like a valve, permitting egress but no ingress of fluids. I judged therefore that the deposit could not be of salivary origin, for saliva could never get there except by injection. Gravity would not take it there, for the extracted tooth had come from the upper jaw. My next pertinent inquiry was, what is its source—what the conditions of its formation, and what is its nature?

Not being accustomed myself to conduct chemical analyses, and not having secured an analysis from any other person, I have not been able to make reliable comparisons of these deposits with salivary calculus as found upon the crowns of teeth. But it is quite certain that we shall not find in it organic matter such as we find in salivary calculus. And we shall not be likely to find any epithelial scales. The chief fact to be observed is that it is *not* found in connection with alveolar abscess, but always when present, is found in connection with *alveolar ulceration*, of which diseased condition it is a *result*, not a *cause.* These facts I have thought sufficient to determine the fact that it comes from the *liquor sanguinis*, the watery por-

tion of the blood. I therefore pronounced it *sanguinary calculus.*

In the *liquor sanguinis* of the blood we have all the elements of bodily nutrition in solution, including the nutrient elements of bone. When in case of ulceration this fluid portion of the blood passes out, by exosmosis, from the blood-vessels, to become the fluid part of pus, it carries with it the lime-salts held in solution and contributes the same to the formation of this calculus. We have also in the blood *hematin*, which yields its coloring matter to the sanguinary deposit. It undoubtedly contains some broken down tissue, and dead blood-corpuscles.

With this rational analysis of the nature and source of the deposit, I concluded that we have on the roots of teeth a distinct formation of calcareous matter, usually called salivary calculus, which is *not* salivary calculus, for the simple reason that it is not and cannot be derived from the saliva. You may designate it *calculus* or *lime-deposit* or *tartar*, if you please; but, deriving its name from the normal fluid which is its evident source, I have called it *sanguinary calculus*, because that is a term seemingly in harmony with the nomenclature of science. The various calculi found in the body are named from the normal fluid from which they are derived. I wish further to state that these two forms of calculus, salivary and sanguinary, are sometimes found in contact with each other just below the margin of the gum, having a distinct line of demarkation between them.

A case was presented at my office in which there was not the slightest amount of salivary calculus, but about the eighth of an inch below the margin of the gum there was a distinct black line of tartar. This indicated sanguinary calculus, which came from ulceration—not the ulceration I have spoken of as originating at the apex of the root, but an ulceration which might have been produced by salivary calculus. But as it had been there for many years the *salivary* calculus had wholly disappeared—possibly by a dental operation, or possibly by solution—leaving only the *sanguinary* calculus, which is known by its color and by its extreme hardness.

Dr. Peirce: Do you not always find the alveolar process to a greater or less extent broken down where you find this sanguinary calculus?

Dr. Ingersoll: It has occurred to some, and did occur also to me, that it is possible that the lime-salts might in part be derived from the broken-down tissues of the alveolar walls; but I think I have seen cases sufficient to warrant me in saying this is not the *chief* source, for it is more in amount than the wasted alveolar margin

could possibly supply. In the case I have stated, while the alveolar margins were thin as note-paper at this point, the incrustation was thicker than ordinary card-board, so the calcareous deposit could not have been derived wholly or in large part from this source.

Dr. Peirce: I wish to confirm the statement made by Dr. Ingersoll, that this deposit at the root of the teeth is from the blood and not from the saliva. I have seen it where I am satisfied there had been no possible connection between the deposits at the root and the secretions of the mouth. This being the case, sanguinary calculus would be a very proper term for it. The condition in which the tooth is found may give us some idea of its origin. The tooth in color is abnormally yellow, the tubuli are all consolidated, the pulp-chamber, if not entirely obliterated, is well filled with calcific deposit, and all of the blood which originally went to nourish the dentine is diverted with its lime-salts to the cemental membrane of the root, and there makes an amorphous deposit of lime.

Dr. Friedrichs: I would like to ask Dr. Ingersoll how many cases he has seen under the condition that he has described, where the supposition was that the calculus could not be from the saliva.

Dr. Ingersoll: I saw a great many cases before I ever understood them, but since I arrived at the conclusion just stated, I have seen not more than twenty cases.

Dr. Morgan: Have you not found this character of calculus in a large number of cases of the so-called Riggs's disease?

Dr. Ingersoll: I call this one of the manifestations of Riggs's disease.

Dr. Rawls: There are two ways by which inflammation may take place within the sockets which are occupied by the teeth: first, from external causes; second, from internal causes. External causes pass from without between the gum and necks of the teeth. The internal cause must be one which cuts off nutrient circulation, and this condition is based upon either a want of integrity of the tissues, as the result of a local force operating thereon, or a systemic condition rendering possible to the parts a local expression.

The gentleman has named the deposit upon roots of teeth in *pyorrhœa alveolaris*, sanguinary calculus, because of its analogy to such deposits in other parts of the body wherein such deposits take place, except upon surfaces by inflammatory action. In the valves of the heart, in the kidneys and in the liver, we do not find such deposits in the internal structure within the parenchema of the part, but upon surfaces which are normal or inflammatory, and I appre-

hend that if the gentleman will inquire into these cases more fully he will find that where he meets with this "sanguinary calculus," so called, there exists an entrance from below or above, as the case may be, for such deposits to be made, and because such deposits happen to be of a different degree of hardness or of different color, is no reason at all why it should be termed sanguinary calculus. For that matter all such deposits might be called sanguinary, since the materials forming them must at one time or other pass through the blood and be a part thereof. In such cases the deposit is simply an impaction of free lime-salts, the result of purely physical action of the tissues and substances involved, and such as you have seen in cases of so-called Riggs's disease, are concomitants, not causes; they follow in the wake of systemic disturbances which have been caused by the action of mercury, salt, or some of these elements or compounds. Tissues under such an influence are readily broken down, pabulum is wept out to build up that which has been broken down because of its want of integrity, and not entirely because of any special local irritant; such tissues are not capable of reorganizing or re-establishing complete nutrient supply between themselves and the tissues to which they were once united. When ulceration (which means separation) takes place, the supply of nutrition will be cut off and never again in these cases be re-established, simply because the source of supply is in contact with a substance which is inorganic, or practically so. It is disorganized organic material.

Before closing my remarks, I wish to call your attention to the fact that we are teaching our patients and students that it is possible to save teeth in these conditions, when there is no possibility of doing so without violating the veriest laws of nature; we are teaching our patients that we can cause healthy tissue to grow and develop over dead substances, without encysting those substances; we are teaching that this tissue will grow over roughened surfaces partly dead, and we expect that living tissue to remain healthy in contact with the dead, when there is no compatibility between the two.

I would like to have this subject thoroughly discussed. I would like some of the older heads, Drs. Watt and Atkinson, Prof. Taft and Morgan, to bring this subject out; I wish to see where they stand; I want to see whether or no they believe there is something in the body which is not material; if they have any cognizance of a force that is called vital, that will influence—will cause cure of these morbid conditions and a return to health when there are no physical signs of any such possibility.

Dr. WATT: I guess I am one of those old fellows that have been called on, but for the life of me I do not know what my young brother has been talking about for the last ten minutes, as I failed to hear. This question of sanguinary calculus is not very mysterious. We have been blundering and stumbling over it until my friend, Dr. Ingersoll, gave it a name, and now it is pretty well known. Calcareous deposits are found in all parts of the system. I think Dr. Taft will remember that the late Dr. Samuel Martin and I removed a sanguinary calculus weighing a fraction over thirteen ounces that was imbedded between two of the muscles of the abdomen. It was about the shape of a hen's egg. It was of a dark reddish color, not so black as the calculus usually found on the roots of teeth under these circumstances. I do not see that there is much mystery about it. If you have a dead surface and once get a particle of deposit on it, it will take something from the blood at every round of the circulation. Each round of the blood will make it a little larger, and so it goes on. What causes the deposit of sanguinary calculus I am not able to say, but I presume it is the disorganization of the blood so as to cause it to drop the first particle, and this occurs as the result of inflammatory action; in other words, there is death of the blood to the extent that it is not able to hold in solution the whole amount of mineral matter which it is carrying, and hence there is a particle dropped. It is very easy to explain the reason why salivary calculus is deposited on the teeth; whenever the constitution is in such a state of debility and tendency to death as that ammonia is found in the buccal secretions, the last named fluids are not able to hold the normal lime-salts in solution and they are dropped. When the saliva holds in solution free carbonic acid, it is able to dissolve the normal quantity of lime-salts, but when the free carbonic acid is, by combination with ammonia or otherwise, taken away, it is not able to hold these salts in solution and they are dropped. You are familiar with the fact that when you boil ordinary spring or well-water from a lime-stone region, the free carbonic acid is driven off and the carbonate of lime is precipitated on the inside of the vessel used in boiling. It is the same in the mouth. Remove the free carbonic acid and the salivary calculus is deposited. Sometimes you may smell the breath of your patient and find that it is loaded with ammonia. As sure as you find that condition you may look for a deposit of salivary calculus or tartar. It is a very common thing for dentists, young and old, to be surprised. They find after having scraped the teeth thoroughly, having cleaned off every particle of

tartar, and having prescribed an alkaline mouth-wash for the patient to use with a brush, the patient will visit them soon again with the same incrustation on the teeth in spite of the use of the brush and the wash. It is not strange. The wash has taken the free carbonic acid from the saliva and the lime-salts are precipitated. What causes the first precipitation of salivary calculus is plain, but I do not know so well what causes the first precipitation of the sanguinary calculus; but this ought always to be borne in mind, that when the first particle is precipitated, there is nothing mysterious about the continuation of the deposit. The affinity of the deposited particle for what is in the circulating fluid will take a little additional from each round of the circulation. The deposit of this sanguinary calculus will be in proportion to the amount of solid matter in the circulation, or in proportion to the ability of the blood to hold it in solution, and in proportion to the room that there is for the deposit. Upon the apex of the root there is not much room unless pressure should cause absorption of the socket so as to increase the room.

Dr. Thomas: Please tell us from what source we may usually look for the ammonia?

Dr. Watt: It comes from the general breaking down of the system. Sometimes it is given off from the mucous follicles. I have found it when I have cleaned the mouth off very thoroughly, and kept it open until it would ooze out through the membrane itself; testing this exudation with my litmus papers I have found an alkaline reaction from that fluid; placing these in distilled water I have found ammonia in the solution, from which I infer that sometimes ammonia is given off direct from the membrane. I believe, although I am not so sure, that it is given off as an excretion from the salivary glands. Another source is from the respiration. The breath is often loaded with ammonia, and it being very soluble in water, and as nearly every person will do more or less breathing through the mouth, the saliva will sometimes thus become impregnated with the ammonia from the breath, and I think this is the most common mode of impregnation of the saliva with ammonia.

Dr. Ingersoll: There seems to me no difficulty with regard to the source of calcareous matter when we consider what I have before said, that all the elements of the growing body, both of the soft tissue and the bone, are in the blood; and furthermore, that calcareous degeneration is a very common form of disease in all the tissues of the body. We find calcification of the veins and arteries, and calcification of the valves of the heart. What is the source of this

calcific matter, if it does not come from the blood? Only that can be salivary calculus which is deposited from the saliva. It should be borne in mind also that the lime-salts found in salivary calculus are in solution in the blood before they are in the saliva, and biliary calculus before it is in the bile. Hence we might call all calcareous deposits *sanguinary* if we chose to do so; for, in fact, the *liquor sanguinis* is the original source whence are derived all forms of calcareous deposit. But for the purpose of designating one form or locality of deposit from another, it has been common to name the deposit from the normal fluid from which it is more immediately deposited.

Dr. Buckingham: We have all the elements spoken of in the blood, and all these lime-salts are held there in solution. They are deposited in a physiological way in the building up of bony substances. They are carried where they are needed, and by some process that we do not understand they are selected and deposited in molecules taken from the blood itself. Wherever you have a solid dead nucleus imbedded in any tissue you may have lime-salts deposited. That would not be a physiological action, but a chemical action. The first process is governed by what is known as life-force, the latter by what is known as chemical force. We recognize the difference between the live and the dead tissue. We recognize tissue that will build up the structure, and we recognize chemical force that will pull it apart and tear it down. What is the difference? Whenever you bring matter together in a certain condition it develops certain forms and so it goes on building up. They tell us there is no great power beyond this that governs this force, but there is no one yet who has undertaken to say that, who will tell you how thought originates, or who can tell how the motion that comes into the ear is transformed into sound. What is force? What do we know about the force of gravitation? How can we explain it? What do we know of why two matters come together? We are perfectly at sea. There is no explanation of these things. Force is from God. It is the same power that made matter, I don't care whether you say it was a personal God or an agent. Matter came into existence somehow. When matter came into existence, force must have come into existence, and the same power that brought matter into existence must be force. Life must come from living matter; it cannot come from dead matter.

I wish to tell you of a new agent for bleaching teeth. A young gentleman of Philadelphia, Dr. Kirk, has been using and recommends

sulphite of soda and boracic acid ground together, to be inserted into the cavity of the tooth after the cavity has been cleaned out. The pulp-cavity should then be filled so that there will be no passage through the pulp-cavity from the bleaching material. The theory is that the boracic acid decomposes the sulphite of soda and sets sulphurous acid free. Sulphurous acid has a strong affinity for oxygen, and when it takes the oxygen from the coloring-matter it bleaches the tooth thoroughly. I give the formula, without giving it an indorsement, so that any one can try it.

Dr. Morgan: There was a statement in one of the papers that the alveolar sockets were not lined with a periosteum, but that the root of the tooth merely was covered with a periosteum which was united, if I understood the gentleman, to the socket. I take issue there. I think there are two membranes. I think the same periosteum which lines the socket is reflected over the root of the tooth, and that they are connected together by the ordinary connective tissue.

The gentleman propounded the question as to success in the treatment of devitalized or pulpless teeth. There is no such thing as perfect success in those cases. I saw recently two cases from which I removed the pulps twenty-nine years ago last April, so the lawyer informed me in whose mouth the teeth were, and they are in the mouth yet. They have never given him any trouble, but I do not consider that a perfect success.

In the next paper is an allusion to a pus-secreting surface. I do not understand that there is such a surface in the human body. All the secretory organs in the body have a specific function to perform, and though they may perform vicariously the function of some other organ, they do not secrete pus; they simply take from the blood certain of its constituents, it may be because they are in excess or that the matter has served its purpose and has become effete. There are no pus-secreting organs or surfaces, nor is there ever, so far as I know, any organ or surface converted into a pus-secreting organ, or any secretion of pus whatever.

Dr. Atkinson: I wish to call attention to the fact that in pathological literature there are two sides to the question. One is that there is such a thing as hereditary tendency to abnormal action in the nutrition of the body, and the other is that there is no such hereditary tendency, but that abnormal action originates from some impact of unkindly force that sets up every diseased molecular movement in the nutrition of the body. I hold that it is necessary for us to take the middle ground, if we expect to get the basis of a diag-

nosis or of a prognosis, or of a decision of what remedy will be useful. This is after the same manner of all our investigations. It involves two territories that are part and parcel of each other, which have been treated as if they were separate. To get at the point more distinctly we must take as a first postulate, that we regard as an element of organization the atom, and then the question arises whether in the atom there is any ability to operate *per se*, without the impact of force from without, by reason of what is called spontaneous action, or whether there is only a sleeping energy in the atom that requires the impact of some sort of outside energy to excite it into a healthy or unhealthy mode of activity. We are in what the paper calls molecular metamorphosis, a subject known by very few, if any. Only a very few men who have been in earnest as naturalists have attempted to get at how the organizations are built up as the machinery of function. We must remember that when we are dealing with remedies they must contain within themselves affinities which have relation to the affinity in the molecular mass upon which they operate, and to get to that in its simplest way we must reach it in the process of feeding; if we take what we commonly call food—that is, everything which is capable of being put into the machinery that we call the digestory apparatus, which finally is put into the mass admixture of homogeneous heterogeneity—we are able then to hold all possibility of power in this pabulum that is the result of complete digestion, and every act of health or disease depends upon this hidden movement that has been so much ignored by all men who have depended entirely upon mass-observation for their diagnosis and prognosis and decisions of what kind of remedy to use.

We are in trouble mainly, here as in other places, with regard to what is meant by the terms physiological and pathological. Pathology really ought to be physiology, and it is modified physiology. It really means obstruction of function, and, if in its first form, it must necessarily be normal, but all the literature of the profession says that physiology is the normal action, and when it becomes abnormal it is ranged under the head of this Section.

Dr. Friedrichs: I understood you to say that when a physician is administering medicine or a remedy, the remedy must have a molecular affinity for the disease he is treating. Did I understand you correctly?

Dr. Atkinson: Either molecular or atomic.

Dr. Friedrichs: Don't you think that you make a rather broad assertion there?

Dr. Atkinson: I don't care to be quizzed about the breadth of my assertion, if it is true.

Dr. Friedrichs: I do not think there is a man in the practice of medicine in the world who actually knows the effect that a medicine will have when he administers it. Only from empirical knowledge or from mere observation, can physicians say that if a certain remedy is administered perhaps certain results may be attained, but they do not know how the medicine acts or how these results are obtained.

Dr. Atkinson: I do not see that that is a question.

Dr. Friedrichs: I think it is a generally conceded opinion by all enlightened physicians, that so far as the influence of medicine is concerned we are considerably in the dark in regard to its action, and I can hardly take for granted that there is a molecular affinity contained in the medicine to cure the disease.

Dr. Atkinson: I don't think I catch your question. I think I can help you by naming the formula I use to my pupils when I am speaking of the changes of food. I say that the feeder has to be fed upon a substance that has died, has had a life-career, and that that substance must have been passed into the condition that is called died or dead, but that being only died and not entirely effete, anything that is capable of being used as food may, under certain circumstances, become either poison or remedy, by reason of the satisfaction or dissatisfaction of the typal proportion of energy in the tissue that is to be fed or is to be restored; and this depends solely upon that hidden law of affinity that resides in the atoms. We have not been able to get behind atoms, but we find that they are in combination; for instance, take water, H_2O—we used to say HO. What do we mean by putting numbers to the symbols? We mean bonds of energy or measures of affinity. And when they are brought together by an electric or magnetic current from the positive to the negative pole, we have two gases that are combined into a liquid which we call water, and it is by reason of the awakening and engaging of these bonds of affinity that they form water. Everything in medicine does that very thing, and that is what we call molecular action.

Dr. Friedrichs: I do not wish to discuss this matter, because we might talk all day and arrive at no conclusion. The main thing in all scientific discussions and papers ought to be demonstrable facts, and in discussions of this kind where no facts can be brought for-

ward we do not derive any benefit, and that is the point I wished to make when I spoke in regard to the effects of medicine as given to cure disease. The facts have not yet been sufficiently demonstrated to show in what mode they act. They may be either a food or a poison, but, nevertheless, we make use of them, because through observation we have found that certain results are obtained from their administration, and that is all. As to how these results are effected we know nothing.

Dr. Buckingham: Matter is inert. It is only when combined that it produces its effect. We do not know how medicines act, but we know that if we use a certain kind of medicine it produces a certain effect upon the individual, and if by repeated experiment we find its action uniform, we are led to believe these phenomena establish a law. We cannot tell whether the medicine acts as a whole or whether it acts through decomposition. Some medicine acts by being decomposed, and thus acts chemically. Some medicine acts as a whole. Several of our strongest poisons are composed of the same elements in very nearly the same proportion. Carbon, hydrogen, oxygen, and nitrogen, compose nearly all our strongest poisons, and yet these are substances that we are taking in constantly in the shape of food. When these elements are combined together in certain proportions they produce certain effects. By repeated experiments of these matters we may judge to a certain extent how the substance works.

Dr. Watt: The statement is too general, that we do not know how medicines act, and that we know nothing about them. It seems to assume that medicine is medicine, that medicine is a unitary idea. Now, we do understand how some medicines act, and we do not understand how some others act. Take as an illustration the treatment of malarial disease—our autumnal fevers, especially in their chronic form—by the use of arsenious acid. The manner in which that medicine acts is very simple. The man in working Indian corn acts in such a way as to kill the weeds without interfering with the corn, and we administer arsenic upon the principle of interfering with the germs of organisms which cause the disease. Here is a chronic ague, and the tissue has been built and rebuilt, and taken down and rebuilt anew, and here is a great lot of morbid tissue. It is not as thoroughly alive as the tissue built up in a state of health, therefore it is easier killed. Now we introduce our poison,—for it is a poison and medicine both,—we introduce arsenic in that case to kill these morbid tissues, because they have a lower vitality than the best-made tissue in the body. The

medicine may have such strength as to kill them and not kill the healthy tissue, and then the emunctories carry out the dead matter. So there is one medicine, the action of which we know. Take another instance: An anæmic girl comes to us almost bloodless. Some reason exists why she lacks red corpuscles. There has to be an improvement. It is found that iron is an important constituent of the red corpuscles. It is better to furnish the iron in some assimilable form to aid the system in taking it up, in order to get it into the red corpuscles. We often administer food that contains iron as one of its constituents, or if we take the finely-subdivided iron precipitated by hydrogen, we will get iron in a shape that the system, will appropriate in some way or other—I do not mean to tell you how. Some of you say it cannot be assimilated, but I know very well that I have seen scores of pale girls and boys just take metallic iron sprinkled on their bread and butter, and the red blood was developed in them much faster than in their brothers and sisters who did not take the iron. We know how that acts. Some medicines we do know. I think I have illustrated that we do know something about how some medicines act, and we do know a good deal about how food acts, and I don't think I am ready to subscribe to what my friend from New Orleans says. He nearly always sticks to the point, but I do not think it will do to assume that we know nothing about the effect of medicine only empirically. My opinion is that all medicines act chemically, but I will not press that.

Dr. Buckingham: The doctor says he knows that arsenic produces such an effect. How does it produce that effect? Does it combine chemically, or does it act by its presence?

Dr. Watt: It combines chemically and kills, just as it combines with the albuminous tissue of the rat and kills it.

Dr. Buckingham: And arrests the vitality?

Dr. Watt: Yes; produces a state of the machinery that is incompatible with vitality.

Dr. Buckingham: How do you find this out?

Dr. Watt: By analysis.

Dr. Buckingham: You find that it arrests vitality by experiment?

Dr. Watt: I find by experiment that it kills the rat, and by analysis I find out how it kills it.

Dr. Atkinson: That is experiment, too.

Dr. Friedrichs: I believe that it is customary before physicians treat a case for them to know the cause of the disease they are treating. The doctor said he knew how arsenic acted in case of

fever. Now, in order to get the medicine to counteract the cause we should know what the cause is. I would like to ask the doctor what causes chills and fever?

Dr. WATT: Go up to my friend Dr. Saulsbury, of Cleveland, and he will show you the little trees. I am not a microscopist, but I have looked at them through the microscope, and they have been taken away to the tops of the Alleghanies and placed on a sleeping-room window, and the sleeper of that room, all unconscious of what has been done, has contracted autumnal fever.

Dr. FRIEDRICHS: Is this question settled in the medical fraternity—the cause of chills and fever?

Dr. WATT: It is settled, but a great many don't know that it is settled.

Dr. KULP: The doctor spoke of children being improved by taking metallic iron upon their bread and butter. I have always contended that in taking medicine for curing disease, it is necessary to take it in such form that it would assimilate easily, and the point which Dr. Watt made, that he saw this great improvement in these patients by taking metallic iron on their bread and butter suggested to me that that was the very reason they were improving,—because they were taking it on the bread and butter. If they had taken it in some other form, nature would have rejected it.

Dr. ODELL: It strikes me that Dr. Watt has sufficiently made out the case that he does not understand anything about the action of medicine, and that consequently Dr. Friedrichs was correct in his statement. The "action of medicine," so called, to a certain extent, we understand; at least we think we do; but when you come to the question underlying that which Dr. Friedrichs asked of us, or of Dr. Atkinson, that is too much for us. How the medicines act, is always a point to which we cannot go. Certain medicines act by assimilation; that is, they must be assimilated in order to act at all, and when we have gotten that far we think we have answered the question, and we have only begun; we are hardly at the A, B, C. We only know that a medicine being present, the result follows, and that is empirical; and when we come to the *how* (which was Dr. Friedrichs's question) we are quite at our wits' ends, and we have no means yet discovered of arriving at the solution of this question. Other medicines act simply by presence. Take the substance of nitrate of bismuth as an illustration. I don't know that you may really call it a medicine in the ordinary acceptation of the term. But it acts by slathering over the surface of the intestines, in conse-

quence of which protective coating all the benefit arises; but we get no assimilation, consequently there is one case where assimilation is not necessary. In speaking of the action of arsenic, Dr. Watt simply stated to us what has been stated for a hundred years or more, that arsenic cures or removes the difficulty; but he has not the first glimmering of an intimation as to why or how it does act. I think we can come a little nearer than that; for arsenic is a medicine which by proof, by tests which are within our reach, has been shown to act upon the nervous system; so by simply a change of the mode of motion (if you may so call it) of the nervous system, we get a different sort of movement, which enables the system itself to resume its normal train of action. Whether arsenic can kill certain low forms of life within the system in the method that he intimates, is to me quite doubtful. It is possible that it may, and it is possible that it may not, but my judgment would seem to intimate that it rather enables the organization itself to work on in its normal train, and thereby get rid of all that is irritating and all that affects the nerves deleteriously.

Dr. Watt: I don't believe Dr. Odell heard me. We do know that these lower organisms die under the administration of arsenic, and that they and the arsenic come out together. It is extremely improbable that the arsenic has its influence on the nervous system by virtue of its affinity for these objectionable albuminoid substances. It simply gives the nervous system a chance to act by cleaning out the débris. The nervous system is always ready to act, if it is healthy and normal, unless there is foreign matter crowding it, and we know that arsenic meets these substances that I have referred to, and comes out in combination with them—that these effete matters do come out and are expelled in the excretions. We know about as much about the action of some medicines as we know about anything. We do not know how it is that the plow turning a furrow pulverizes the soil. We do not know why the soil does not stick together and lie there just as it was before the plow turned it over—that it is not as solid as it was before it turned it over. We do not know why the horse pulling the plow impels it through the ground. We do not know anything in the sense in which Dr. Odell has criticised me. I will acknowledge that I am the leading know-nothing in the whole assembly, but I object to the statement that, as compared with our knowledge of other things, we really know nothing about the *modus operandi* of medicine. There is a sense in which we know nothing about it, and in which we know

nothing about anything else. There is a sense in which we know something about plowing, something about sowing, something about planting, and something about the action of medicine.

Dr. Odell: The underlying idea that I had in the first place was that, whereas, we always sneer at the word empiricism, about all we know of medicine is empirical, and what we call science is simply the classification of empirical discoveries. It is the part of science to give a reason for what empiricism always discovers. I want to disclaim the idea of attempting to criticise the remarks of any one. I only wish to criticise the ideas which these remarks seem to contain, as coming from apparently such high authority. The way in which some of these actions go on we have learned to a certain point, and we have learned it because we first discovered that such was the action, and then we experimented and saw the same results follow the same causes, but when you come to try to define the effect that certain medicines have upon certain organs you are at fault; and yet more so, when you attempt to follow out the mode of action as upon masses, molecules, and atoms. In the oxygenation of the blood we think we understand the "how" by a mere transference of oxygen to a molecule which demands it, and which is ready to affiliate with it, but when you come to the action of any other known thing upon the tissues of the body, we can merely make a hypothetical statement as to what takes place. Beyond this we enter into the domain of the breaking down of molecules into atoms, and the recombination of those atoms, of which we as yet know very little.

Dr. Watt: If we have a knowledge of the action of oxygen, we know how one medicine acts, and that carries the point.

Dr. Odell: That is our type, and that is the reason for trying to find out more, but we have not got that far yet.

Dr. Atkinson: We talk of tonics and we talk of stimulants. Let us see if we can make a statement that will define the action so as to be comprehensible. We have a functioning body made of molecules. There is no such thing as cell-action alone; it is molecular action in combination, that is, a host of molecules gather together and group in a small body that we call a granule, whereby we get that mass-action that we are able to perceive by the senses. But there is a finer mental sense of reasoning by which we must perceive the change that occurs between the pabulum and the needy body, so that it shall be fed. This impact of energy that operates upon a hungry molecule, that does not combine with it, but simply awakes local energy in it so as to perform the function belonging to

the part, is a *stimulant.* Any impact or substance that is taken into and combined with the molecule, therefore, becoming part and parcel of the molecule, is a *tonic.* Tonic then is a food in every instance. The stimulant is the action by presence, referred to by my friend who last occupied the floor. If we make a few of these simple corrections we will regard with less reverence the massive nonsense that has been presented to us as physiological and pathological activity. One word in relation to matter being dead: Every atom has a living and a dead side—that is, a dynamic and a static side, a side of energy and a side of statism or absolute massism. It is doubtful whether we can conceive that atoms ever originated, but when we trace them we find them endowed, as is said, with power, that is, in their normal condition; in their dead condition, when we examine them as atoms, they are in a sleeping state. What is it that sleeps? It is the dynamism, it is the power, it is the energy that resides in it that is omitted,—I do not want to say cause, but I have to say it, —that is motion,—for we really know nothing of causes, we simply know their incidents and consequences. If you have the point, it is this, that we must be more careful in discriminating about these things, whether they be foods, whether medicines, or whether they be poisons. Anything that can act upon a molecule can be denominated either food, poison, or medicine.

Professor Mayr: Dr. Watt said that arsenic killed certain lower organisms, and that they were eliminated. This is what I plainly and squarely deny. As example I give the fact, that in my laboratory there were two bottles in which the mould was thick. One contained a solution of arsenious acid, and the other contained arsenite of soda. These were at that time the only two bottles in my laboratory thus affected. I had a frog that died. I put it in the most concentrated solution—the arsenious acid. After a fortnight the mould was as thick as possible. The power of arsenic in killing the lower organisms is exceedingly weak. The effect of arsenic was, in my opinion, rightly described by Dr. Odell when he said that it acts upon the nerves. It is what might be called a stimulant, or rather tonic, by Dr. Atkinson, and in this way, by stimulating the nerves to greater activity, it exerts its influence.

Dr. Watt: Were the bottles uncorked?

Professor Mayr: Both were uncorked.

Dr. Darby: We sometimes imagine we know the action of medicine, and yet we are all at sea about the action of arsenic when applied to the dental pulp. Some are of the opinion that it is absorbed,

while others are as strongly of the opinion that it acts by catalysis (by its presence). Dr. Flagg is on record as having said the following: "Then came the action of arsenic on the pulp. I placed a small portion of arsenious acid—one twenty-fifth of a grain—on a piece of cotton, mixed it with acetate of morphia, the whole being in turn mixed with creasote, placed it in a pulp-cavity, and devitalized that pulp. I made *that same* application to a number of teeth, and I left the cotton in each for two weeks, and in some, I think, for three weeks. Each one of those pulps I extracted from those teeth painlessly. It was a perfect devitalization of the pulp. They were taken out and held up before my patients, and they were told 'that is the pulp of your tooth,' and when I held this up and told them, every one of the ten said, 'is it possible that you have taken that from my tooth without my knowledge?' If they did not know it, it could not have hurt them much. These pulps were then placed on paper, the terminal ends where the arsenic came in contact with them were cut off, and the remainder of the ten pulps analyzed in a bunch. They were treated by Reinsch's test for arsenic, which detects a two-hundred-and-fifty-thousandth of a grain. In the whole ten there could not have been the two-hundred-and-fifty-thousandth of a grain, because there was not the ghost of a shadow of a show of arsenic. Now, if there was not the ghost of the shadow of a show in ten pulps, how much was there in one?" If I mistake not, that same piece of cotton with the twenty-fifth of a grain of arsenious acid was afterwards applied to the web of a frog's foot and it killed him as dead as a door-nail. I would not be understood as vouching for the correctness of this statement. It would be difficult to imagine so small a quantity of arsenic producing such wonderful results if it acted by absorption.

Dr. Atkinson: Was the twenty-fifth of a grain not diminished in quantity? Did he weigh it afterwards?

Dr. Darby: I don't know.

Dr. Atkinson: That is the point.

Dr. Buckingham: I think I know something about that frog. I helped Dr. Flagg analyze it, or rather I analyzed it while Dr. Flagg looked on. Our tests were not very carefully made, but we found what we supposed to be arsenic in all parts of the frog. I did not see the other twenty-five cases in which arsenic had been applied to the mouth, but there was arsenic certainly absorbed and deposited through the whole system of the frog. I refused to indorse his paper, and the consequence was he went home and said he had re-

peated his experiment, and published a paper over his own signature. I would not have anything to do with it. We do know that a very small quantity of arsenic will produce an effect, and although the twenty-fifth of a grain of arsenic will kill a dozen teeth, it does not follow that there is no arsenic absorbed, and we can explain this very easily, because when the pulp was killed the arsenic would be absorbed very little, there would be a cushion through which the arsenic would have to pass before it got into the other parts of the tissue. Arsenic may kill, and yet there may be an almost infinitesimal portion absorbed, but certainly arsenic must act some way rather than by its presence. I agree with Dr. Watt that there may be a chemical combination between the arsenic and the substance itself. Arsenic will act upon that which is weak, and it destroys the vitality in some way, but I don't know how it does it. When the quack doctors undertake to remove tumors with arsenic they apply it to the tissue that is weak or abnormal, and it will devitalize that tissue before it attacks the others. If it is applied to a healthy tissue it will be absorbed clear through, but if applied to diseased tissue it will probably destroy a portion of it, and that tissue becomes a cushion which prevents the absorption of the arsenic, and probably there will be a sloughing off. As to the minute action of the arsenic we have not a very clear idea, and we only know any of these things from experiment.

Dr. Allport: The action of medicines is a very difficult thing to explain; from observation and experience we have learned to expect certain results from their administration; we know they act, but why they act we do not know. We know that we live, and we know that grass grows; we know that foods produce the growth of tissues: but why we live, or why and how these growths are produced we do not know. Life and growth are the results of vital action in obedience to laws of the Infinite which are beyond man's comprehension. Observation and experience have taught us that by mixing an alkali and an acid, we get what chemists call a neutral, but just why we get this result, or why it was ordered that we do not get some other result is known only to Him who created the law. With reference to the action of arsenic in destroying the vitality of the tooth-pulp, and in regard to Dr. Flagg's experiments, I wish to say a word. I do this, not that I wish to fully indorse his conclusions, but because it seems to me that his ideas are not clearly understood here. I read what Dr. Flagg said on this subject many years ago, with a great deal of interest, and I will state what I remember

to be the substance of his experiments as well as the conclusions which he drew from them. He destroyed the vitality of a great many pulps by the use of arsenic, and at different times he collected numbers of them and applied the most delicate chemical and other tests to ascertain whether arsenic had been absorbed or not, and if absorbed, to what extent, and in what part of the tissue it existed. In these tests he found that the least possible amount had been taken up, and its presence was only detected at the point of contact of the drug with the tissue. From this he came to the conclusion that the death of the pulp was not so much from the absorption of the arsenic as from irritation by its presence. His conclusions were that irritation caused an increased flow of blood to the parts (which is always the case with irritation), and that the arteries became so much enlarged that they prevented a return of blood through the veins, and that death was caused by strangulation at the apex of the tooth. In my own practice I have found that much less arsenic is required to destroy an unwounded pulp than one where the pulp has been wounded. I have also found that in some cases by applying arsenic a portion of the pulp would slough off and the balance of the pulp would take on a healthy action and live for years. I doubt not that Dr. Atkinson and others who have paid particular attention to preserving the vitality of exposed pulps have met with the same results.

Dr. Buckingham: How does he explain how the arsenic got through the whole system of the frog?

Dr. Allport: That he did not explain.

SECTION VII.

Physiology and Etiology.

The Origin and Physiology of Nervous Force.

Paper by W. C. BARRETT, Chairman of the Section.

THERE are two things of which I wish to speak, and these two things make up the sum of the whole universe, so far as man can know. They are matter and force. I say the study of these must form the whole, the entirety of human research, so far as any positive knowledge, or the hope of definite information is concerned. We may speculate and theorize and dogmatize upon things spiritual and metaphysical as much as we like, but concerning them we can by no possibility arrive at any definite conclusion, nor can we *prove* any assertion, it matters little how wild it may be, as either absolutely true or false. When we come into the domain of physics we are studying the actual, the real, the tangible.

I desire, then, for a few moments to consider in a general way matter and force: the one real, positive, palpable, inert; the other immaterial, ethereal, incorporeal, yet dominative over the tactile mass—a law which is ever active in bringing about definitive changes in the passive matter; a ghostly, pervading something, which changes a dead, a lifeless, an inanimate mass of chaos, into this world of life and joy and beauty and animation.

What is this mysterious influence that we call force? Let us examine it. But in what I have to say I desire it ever to be borne in mind that I am speaking solely of physics, and that it has no kind of metaphysical or speculative application whatever. The relations of mind to matter it is no part of my present plan to endeavor to trace out.

Force can be studied only through its chief resulting phenomenon—motion. We find that matter and force are infinitely opposed. Matter seeks eternal rest; force perpetual motion. They mutually react upon each other, matter being by force constantly changed in its characteristics; force by matter continually varied in

mode of manifestation. They are thus mutually interdependent, co-existent, eternal parts of one stupendous whole: interdependent, because one cannot form a portion of this universe without the other; co-existent, because each pervades the other, and eternal, because both can die only together. It has long been an axiom in physics that matter is imperishable. The same train of reasoning which proves this, establishes also the fact that force is indestructible. If an atom can change its condition only through the exertion of force, if its form only can be altered, the bonds which unite it to certain other atoms only be liberated to enable it to form new unions with yet other atoms, and yet if not one of those particles can be lost or annihilated, then can force, only by the reaction of matter, be induced to change its mode of manifestation or its direction. If not an atom has ever been destroyed since matter existed, then it necessarily follows that not an influence, not a wave of force has ever been extinguished since, simultaneously with matter, it first exerted sway. We may, through the action of force, alter the condition of matter; we may, through the reaction of matter, change the character of force; but both are alike indestructible and eternal. Matter is all one, under whatsoever form it may exist. Force is a unit, however it may manifest itself. These are predicates, truisms, self-evident, self-proved, fixed laws of physical science. This doctrine is not new, for as long ago as 1845 Faraday declared that he held the opinion that the various forms under which the forces of matter are made manifest have one common origin, and are so mutually interdependent that they are convertible one into another, and possess equivalents of power in their action. To my apprehension, matter and force are as intimately connected as are what Faraday calls the different manifestations of force with each other. We cannot conceive of matter except as it be subject to force. We cannot imagine power as distinct from the matter upon which it acts. They are essentially co-existent, coeval, synchronous.

Force may act upon matter in different ways, and the result may be motion of a mass, or of atoms. The changes consequent upon this action may be those of external form—morphological, or of internal structure—molecular. According to the peculiar manifestation of it we have been accustomed to call it heat, light, electricity, or chemical affinity; but in whatever mode it becomes sensible to our perceptions, there is one definition which will always describe it, one expression which always characterizes it: it is essentially matter in motion. Heat was formerly regarded as a subtle

substance, with unknown, tangible qualities, and its specific name was *caloric*. It was, with light and electricity, classed as an imponderable fluid, because it was conceived that no other hypothesis would account for the phenomena which they exhibited. Light, it was supposed, consisted of minute characteristic particles, which proceeded from the sun, or from any luminous body. Electricity, also, was regarded as an invisible entity of some kind, possessed of peculiar qualities. It was known rather by its physical manifestations than from any knowledge of its character, but the general opinion held it to be an extremely tenuous matter, which, while pervading most substances, could yet be bottled up, confined, or dissipated at will. It was usually spoken of as the electric *fluid*, and in my early school days I was taught that there were two kinds of electricity—a positive and a negative—which were always seeking to neutralize each other. Further study and investigation made manifest the absurdities of those crude theories, and a new hypothesis was invented—that all these supposed entities, these actual, positive existences of some kind of matter called light, heat, etc., really acted through a specific medium, a fluid which pervaded all matter and all space, an invisible, intangible ether, which, once put in motion by the action of light, heat or electricity, had sufficient power to produce all the violent phenomena which were supposed to be the effects of these agents, and this hypothesis is held by many people to-day. Count Rumford disposed of the material theory by immersing two iron or steel bodies in cold water, and then by the friction or attrition of the one upon the other gradually raising the water to the boiling point. This was the initial attempt at removing the consideration of the study of force from the domain of metaphysics to that of physics.

Prof. Grove first publicly announced the modern theory, that the so-called imponderables, light, heat, electricity, etc., are peculiar states of ordinary matter; that they are resolvable into motion, that they are in fact all very closely connected, and the new doctrine was denominated the Correlation of Physical Forces. The doctrine was taken up by others, the real nature of the so-called forces was studied, and the further proposition was enunciated that they are all mutually convertible into one another. It was necessary in the consideration of these forces to study them in their manifestations, to compare them with other physical phenomena, and to note their resemblances or their discrepancies. It has been determined that most, if not all, the forces progress by means

of an undulatory or wave-like motion, not unlike the advance of the concentric waves made by casting a stone into a smooth body of water. This hypothesis is firmly established as regards sound, not only by actual measurement of the vibrations of resonant bodies, but by the very structure of our own auditory apparatus.

The vibrations produced by light have not only been demonstrated, but accurately measured. And not only this, but it is very clearly shown that the different colors of the solar spectrum are produced by a definite number of vibrations upon the retina of the eye. Further, the very number of these wave-like beatings has been ascertained and counted. The most delicate, but at the same time the most determining experiments have been conducted, and these demonstrate that to produce the color at one end of the solar spectrum, red, 480,000,000,000,000 of these vibrations must impinge upon the retina in each second; while to produce violet, the color at the other extreme of the spectrum, the number of vibrations per second is no less than 720,000,000,000,000.

The same arguments which are applicable to the undulatory theory of the progress of light, are equally pertinent in the consideration of electricity, for its mode of progression has been shown to be nearly allied to that of light.

And now, let us for a moment consider the characteristics of some of these forces. Sir Humphry Davy says that the immediate cause of the phenomena of heat is motion, and the laws of its communication are precisely the same as the laws of the communication of motion. We know that all molecular motion is accompanied by the evolution of heat to a greater or less degree. This is equally true whether it be of the changes incited by what is known as chemical action, or the motion induced within the mass of iron upon the blacksmith's anvil. We also know that the same molecular disturbance generates what is known as electricity, and that both these elements are operative in inducing that change sometimes called chemism. It is equally true that each of these forces is convertible into any of the others. Thus, if we commence with chemical action, we all know how, within the cells of the battery, this action is made manifest in the electrical current, and thus chemical force is converted into electrical force. If now this force be generated in sufficient quantities and conducted along a wire of sufficient size for its easy transportation, and if in this "circuit" a piece of small platinum wire of such size as to partially obstruct the "current" be inserted, we all know that the platinum wire soon becomes red-hot, and we

see an instance of the conversion of electrical force into heat. The galvano-cautery is an illustration of this. If now the current be increased, and the obstruction be entire at one point, the most dazzling radiance is manifest, and here we have an example of the conversion of electricity into light. The electric light is an illustration of this.

Here, then, commencing with that simple molecular disturbance within the battery, we see the force generated by those movements manifested first as chemical action; this is converted into electricity, the electricity into heat, and the heat into light, and all without the addition to or the substraction from the original force, as first made manifest, of anything whatever. This proves conclusively that whatever name we may give the phenomena exhibited, they are all due to the same cause, have the same origin, are convertible the one into the other, are in fact all the same thing, differing only in the mode of their manifestation and the accompanying phenomena.

The sun is the great source of light and heat for this earth. The so-called rays of the sun may be made manifest to us in many different ways. If, for instance, we take our stand with that body exposed directly overhead, its influence is chiefly exhibited to us through that which we call heat. But we may interpose between us and the sun crystals of alum, and these will intercept those undulations which are known to us as heat, or in other words, it will so change the character of these vibrations that the sun's influence is no longer manifest to us as heat, but the heat-rays have become light-beams. In other words, the heat is converted into light. Again, we may interpose another substance, and there is neither heat nor light in the sun's influence, but its rays now induce those molecular changes which we know as chemical action. Thus the same rays of the sun may be changed and made manifest to us as light, heat, chemism, or electricity.

Force, then, is but a mode of motion, and according to the manner in which it is manifest to our senses we call it by the names which I have considered. But force may remain latent for an indefinite time. In my school-boy days, when we considered heat, or caloric, we called it either sensible or latent. Further study will teach us that such terms are the result of our lack of understanding of the subject. There may, in one sense, be such a thing as latent force, but heat is only a method of the manifestation of force. The sun is, as I have said, the origin of all force, because within its body certain changes were originally organized and put in motion, whether by Omnipotent power, as our system of theology teaches, or

by inherent qualities, as materialists claim, it matters not in this connection. These molecular changes are the origin of the unit force. The effects of these changes are eternal, imperishable, indestructible. But they are not necessarily incessant. They may be stored up, imprisoned, only to be liberated through the transference of some other influence. As thus: in the early carboniferous ages the force liberated through the changes going on within the sphere of the sun being manifested upon the earth as light, heat, and chemism, induced certain molecular changes here, which resulted in the new combination of the elements of matter then existent, and the consequence was an extraordinary organic growth, and the formation of the carboniferous forests. The continued force, which had its initial point in the sun, still active, but modified by previous changes of the same matter, and by self-limiting, environing circumstances, finally resulted in those immense carbon deposits which to-day form our coal-fields. The coal which burns in my grate is but the imprisoned force which was originally derived from the sun, and which came in the form of light, heat, electrical, and chemical changes. For proofs of this we have but to subject it to favorable influences and there will be returned to nature the same identical light, heat, chemical, and electrical forces which so long lay inactive, dormant, latent, imprisoned within the coal-bed. It is capable of demonstration that the amount returned is the exact amount so long ago received from the sun. But the light, heat, etc., or in other words, the force liberated in my grate is not lost or wasted, but is absorbed, appropriated, perhaps imprisoned within other masses of matter, to be in turn again yielded up and again utilized. Or, perhaps the force so eliminated from the coal is at once made manifest in some other mode of motion, and thus transmitted on and on, now exhibited as heat, now as electricity, and again as light or chemical affinity.

I might enumerate very many instances wherein one manifestation of the unit force is changed into another. I might speak of the heat, the light, and the electricity which in various ways accompany or are the result of all chemical action.

I might show that electricity and light and chemical action are ever attendant upon the development of heat, and that heat and light and electricity are the accompaniments of the development of chemical action; but it is all summed up in the declaration that all movements of matter, in whatsoever way they may be brought about, are producers of the unit force in some one or more of the methods of its manifestation. I cannot open or shut my jack-knife without

the evolution of heat and electricity in greater or less degree. If I bring the blade of my knife in quick, sharp contact with another substance sufficiently hard and brittle, heat and light are made evident to the senses, as in the use of the flint and steel.

The evolution of force and its methods of manifestation are controlled by definite laws, which are as yet in a great degree unknown to us. Prof. Grove says that the law or rule as to the production of heat or electricity from friction or percussion is that when the mutually impinging bodies are homogeneous, heat is the consequence; but when they are heterogeneous, electricity is evolved, although either is in a greater or less degree the constant accompaniment of the evolution of the other. In fact, it is true that the production of one force or mode of motion is, as a rule, accompanied by more or less of the others. The beautiful photographic process, which is but the conversion of light into the molecular motion commonly known as chemical action, is accompanied by the evolution of heat and electricity, though in quantity not appreciable to anything but the most delicate apparatus. If I bend a poker across a chair-back the molecular disturbance of the iron, if it be measured by thermometers and electrometers of sufficient delicacy, will distinctly show an alteration in temperature and electrical condition, and this is true of every change in the relation of the atoms which go to make up matter.

Matter is composed mainly of four simple elements—oxygen, hydrogen, nitrogen, and carbon. Of these four three are gaseous, and their atoms move freely and with little friction. Many of the compounds of these elements are what are called allotropic, or isomeric—that is, two bodies are composed of exactly the same number of atoms of each element, and yet they are totally unlike, because the *relation* of the atoms is not the same. Thus the oils of turpentine, lemon, and juniper are chemically the same, yet physically different. So that it is seen that very slight atomic or molecular changes produce wide divergences in the character of compounds. Then, too, there is abundant opportunity for such changes to be brought about by a very slight exertion of force. The compounds of nitrogen (and this includes all the so-called albuminoids) are very mutable, and are ever seeking for some more permanent union. The exhibition of the slightest force is sufficient to induce a disruption of imprisoned chemical affinities, which may result in wide changes.

Again, compounded matter exists in a number of forms, as gaseous, liquid, and solid. Of these the first two are easily impressed, and

molecular changes are constantly going on. Solid matter exists in two different states—the colloid and the crystalloid. Of these the first is unstable and exceedingly mutable. So that of all the forms in which matter exists, there is but one in which it is not easily changed and made to assume new molecular conditions. We have shown that every such molecular disturbance, however induced, is followed by the evolution or the transference of some one or more of the various manifestations of force. Given, then, that most forms of matter readily undergo molecular and other changes, and that the manifestations of existent force, such as light, heat, chemism, etc., are constantly active, and that such action can only result in still another transference of force, it may readily be seen how unceasing must be the phenomena presented by all these mutations and mutually-induced changes. Every wave of force exerted at the initial period of this universe has been since that time and ever will be existent, and either constantly, actively exerted, or passively imprisoned by superior force. Matter is, under the action of force, constantly being disintegrated and its constituent particles built anew into fresh forms. And so this tearing down and redistribution of matter is, under the dominion of force, constantly going on. Every organized being, whether animal or vegetable, has its period of molecular aggregation, of growth and so-called nutrition, of active, progressive changes, and then the same forces which have resulted in the combination of the molecules which make up its substance, are again active in those yet further molecular changes which bring about its morphological destruction. I say the same forces which brought together the molecules which compose this body of mine, will in time insure their separation, and thus bring about the disintegration of solid and fluid tissues, and return them again to the common stock of matter, while the energies which brought about these definitive changes, through the reaction of the matter thus metamorphosed, will in turn be transformed into other forces, and itself returned again to the parent or unit force whence it was segregated, and thus will all that which goes to make up this Ego, this individual I, be returned again to that great source from which it emanated.

If this doctrine of the unity and the correlation of forces be admitted as true in its application to the various forces of which we have been speaking, are we not justified in assuming that the law is general throughout the material universe? And whether we study this unity as exhibited in the macro-cosmos, or in the micro-

cosmos—in the revolutions of solar systems, or in that affinity which binds together two atoms; in those early convulsions which resulted in the upheaval of continents, or in the change which culminates in the growth of a blade of grass; in the devastating earthquake, or in the fall of a leaf in autumn; in the whirling in infinite space of a planet, or in the infinitesimal vibrations of a ray of light; in the action of volcanic fires, or in the molecular changes within the single battery-cell,—we shall see that in any extreme it unfailingly exhibits the same characteristics. It is the exhibition of the same force which results in the molecular aggregation called man, and that of the lowest organic life. Within the two organizations constant molecular changes are going on that differ but in degree. The results of those changes in the two are precisely alike in fact. Life—vitality—in the one is, in a physical sense, precisely what it is in the other, except that in the lower it is simple, and all the processes are elementary; in the higher it is complex, and not readily comprehended.

And now, having considered the law of the correlation of forces in its application to the lower forms of matter, shall we stop when we are just upon the threshold of the secret places of nature? We have shown that in inorganic life the law prevails and explains all the phenomena there exhibited; shall we admit that the harmonies of nature become discords when they are played upon the strings of a more perfect instrument? As we rise in the scale of existence shall we conclude that, where before all was beauty and harmony and exactness, now all becomes discord and falsehood and incongruity? Shall we admit that the laws which are universal in the lower objects are suspended when we arrive at the point where they are most needed to make things congruous? The world has long accepted as a fact the belief that man is a law unto himself, and that his physical being is not subject to the rules which govern all the rest of creation. The life of one of the lower animals was thought to be one thing, that of man to partake of a very different essence; that the vitality of the shrub which grows by the wayside had no kind of resemblance to the flower which blooms in our gardens. Let us look into this thing.

My subject, as announced, is Nervous Force. Perhaps many of you have wondered if I were to pay it the respect of a passing glance, and if so what my long prelude meant. It was necessary that I first establish and make clear to your comprehension the doctrine of the correlation of forces before I attempted to apply it to other and higher uses.

We have seen that the light and heat of the sun, under favoring conditions, have developed or been transformed into other forces. We have examined those forces, and have found them a unit in their origin, though diverse in their mode of manifestation. We have seen that light may be changed into heat, heat into electricity, and that into chemical affinity; that all these so-called forces are mutually interchangeable, alike, identical; that each is the result of certain molecular changes, themselves induced by manifestations of other varieties of the unit force. We know that all organic bodies, whether of low or high degree, are composed of the same atoms that unite to form other matter, and therefore they must be amenable to the same laws.

There are certain phenomena connected with living matter called vital phenomena. Under the old hypothesis, that there were many kinds of force, and that each was an entity, acting in an independent manner upon such matter as was subject to its influence—it was easy to suppose that nervous force was a something distinct and by itself, and that it was not subject to the laws which governed other forces. When it was believed that magnetic attraction was a pervading something which established a kind of affection between certain substances, and aversion toward others, and that this attraction was a thing by itself, dominated only by its own laws, and owing no allegiance to the ordinances which governed the relations of other matter, then it was easy to imagine that nervous force was a principle alike distinct, separate, and removed from all other dominant forces. In that early day there was no harmony in nature, but a continual clashing and discord among mutually-contending forces. Let us now suppose that nervous impulse is but another mode of manifestation of the unit parent force, and how quickly all becomes harmony and beauty.

The lapse of time admonishes me that I cannot pursue this inquiry with all the minuteness with which I endeavored to examine the physical forces; but that *all* force is identical, interchangeable and the same, seems to me plain for a number of reasons. In the first place, it is derived from the same source. The same molecular changes and mutations which in the battery-cell result in the evolution, or more strictly speaking, the segregation, of electrical force, are here manifest as nervous force. We are constantly supplying the elements of this nervous battery in the food which we take, and those molecular changes which we denominate digestion and assimilation result as such changes ever do and must result, in the elimination of a

force which, in this method of manifestation, we call nervous force.

If an animal be deprived of every kind of food except fats, it finally dies of inanition, though there is no apparent emaciation. The changes incident and necessary to nutrition cannot be carried on in the absence of necessary elements. The molecular changes of the digestive process having partially ceased, there is a consequent diminution in the evolution of nervous force, which finally results in complete functional stasis, or death.

Again, that nervous force is identical with the other forces is manifest from the fact that in many of its phenomena it is the same. As light and heat are modified by other forces as well as by the circumstances under which they are made manifest, so nervous force is dominated by the environments which surround its elimination and exhibition. The methods in which the changes which result in light and heat progress, the elements taking part in such changes, all have an influence upon the characteristics of the force so generated. This is also true of nervous force. When the molecular changes going on within the body in which is generated nervous force are most active, the force generated is greatest. When these changes cease, nervous force is no longer generated and the body is dead. When the products of these changes are for any reason transformed into heat, as in certain pathological conditions like fevers and inflammations, nervous force is decreased. If the body be subjected to intense cold, the transformation of these changes into force is retarded, and not only is the temperature of the body reduced, but nervous force is diminished, and the organs which are controlled and regulated by it become torpid. Certain drugs have the power entirely to suspend these transferences of force, or to modify them greatly. So in the generation of other forces through the chemical or other changes which induce them, the elimination or action may be modified or suspended by the introduction of interfering matter.

Nervous force may be changed into other forces, and on the other hand, light, heat, and electricity may be transformed into nervous force. It is not sufficient that the tadpole be furnished with the necessary food and heat for its development into a frog. Unless light be given him he remains in his tadpole state. If heat be not applied to the freezing animal there will be no nervous force; and how familiar is every physician with the fact that when nervous force seems exhausted, the mere application of heat supplies the

needed nervous impulse—how else than by a transference of the force? If I apply the poles of a powerful battery to the nerves of an animal in which the evolution of nervous force is quite suspended, all the effects of that force are manifested. The heart can be made to beat, and any special muscle to act as in life, for a limited time—how else than by the transference of this mode of manifestation of the unit force? Electricity seems more nearly correlated to nervous force than is any other mode of motion. Indeed, in some animals they seem interchangeable at will. Thus the gymnotus, or electrical eel, by the possession of a more than usually complicated nervous apparatus, can give electrical shocks of considerable power at volition.

The fire-flies and glow-worms are also provided with special organs, by means of which they can emit light at will, as the gymnotus does electricity; that is, nervous force is transmuted into light. In all such animals when nervous force is exhausted, when they are tired out by continued irritation or excitement, this power to emit light or electricity is gone, and it only returns when the nervous impulse is again perfect.

The laws which govern the manifestation of nerve-force are less understood than those dominating the other forces. The force itself seems like an algebraic expression to be raised to a higher power, but that it therefore differs from the others does not follow. When in the light of the theory of the correlation of forces it is intelligently studied, we may hope that its phenomena will be better understood, and its conservation become a wrought-out problem. We have learned how electricity may be stored up,—imprisoned against a time of need. Why should we not discover the same thing concerning its nearly-related nervous force? When the battery ceases to work we know how, within certain limits, to remedy the defect. What hinders our learning the same thing of the nervous system? Many men have striven to gain this knowledge, but not, so far as I know, in the light of the latest revelations of science. Nervous force has been regarded, as electricity once was, as an entity, an entirety, as something distinct from other forces. It is time that men began its investigation from another stand-point.

In the first pages of this hastily-written paper I said that the progression of force is, so far as we now know, by undulations and onward, wave-like motions. This is demonstrated by experiment to be true of nervous force. Even the rate of this advance has been determinately measured, and found to be in the motor nerves about

110, and in the sensory nerves about 140 feet per second; so that we see in its mode of progression it obeys the law governing other forces.

Of the manner in which nerve-force is eliminated we know little, but that it is in some way through the nervous centres we are convinced. Experiment has proved this, and at the same time established the fact of its close correlation with the other forces. When the nerve-centres are destroyed or paralyzed, not only is the production of nerve-force stopped, but the body quickly cools. Upon sending a current of electricity along the course of the nerves, the bodily heat or temperature rises, so closely are these forces connected. If an organic body be deprived of light, not only is nervous force diminished, but the temperature is lowered.

We have all known persons whose hair during conditions of nervous excitement would stand on end, and from whom at such times could be drawn distinct electric shocks. I know a man who, by inducing a restless, agitated, nervous state, in favorable atmospheric conditions, can light a gas-jet by simply holding his finger-tips to the burner. These states are always succeeded by nervous depression, undoubtedly due to a loss of nervous power, through its transmutation into electrical force.

That nervous force is very closely correlated with electrical force is again proved by the fact that all persons of highly-wrought nervous organization suffer extremely during electrical disturbances. So-called magnetic storms induce a condition of great nervous exaltation in many people. Nervously anæmic people derive strength from a gentle electric current, because of its conversion into nervous power. People who suffer from nervous irritability find an exacerbation in electricity. That is, when the lesion is of the nerve-centres,—the generators of nerve-force,—electricity is beneficial; when in the conducting nerve-filaments, it is aggravative, for obvious reasons.

There are many other points and arguments which I should be glad to present, but this paper is already too long, and I must leave the consideration of the subject. I desired to say something concerning a kind of nervous ebb and flow in certain members of the vegetable kingdom—to speak of the stinging nettles and of certain jelly-fishes, which without a discoverable nervous system yet give distinct shocks through some occult means—to speak further of the inordinate waste of nervous force in certain states of excitement or passion—to say something about the anatomy of the nervous system, and to examine a little the phenomena of excessive nervous irritability. I

am even leaving almost untouched one great division of my subject—nervous lesions. I can only plead the vastness of the theme, and the impossibility of doing more than to make a brief presentation of it within the limits of a paper like this.

The importance of a more careful study of the physiology of nervous force is apparent when we remember that the type of American diseases is distinctly nervous, and that from year to year it is growing more so. Reflecting men in the medical profession have begun to recognize that we are making little progress in learning to combat these ills, and they are seriously looking about for the reason. Some of the most profound thinkers in medicine have turned their attention almost exclusively to this field. They have advanced little further than to discover the cause of certain troubles, and lament the inability of the profession to grapple with and overcome the difficulty. Books have been written which have stirred medical men up to a recognition of the importance of this subject, without convincing their authors that they themselves fully comprehended the matter. Is it not time that investigation began from a new stand-point? Is it not time that inquiry took another direction? If any one has studied the subject from the vantage-ground of the correlation of nervous impulse with the other forces, I am not aware of it, but I hope that this may be a door which shall enable some one to enter upon a field that will give richer returns than any have yet yielded.

DISCUSSIONS.

Dr. Buckingham: I only wish to mention a point or two. When we consider the physical growth of life, we can, to a certain extent, reason. When we get beyond the physical facts and enter the field of speculation, we cannot understand the subject. The machinery may be in perfect order, and yet if you apply electricity to it you cannot make a dead man hear or you cannot make a dead man see. There is something beyond which we do not understand; how far we may travel in that line of knowledge after awhile we cannot say, but there is a border beyond which at present we cannot pass. I do not wish to occupy any of the time, but merely to state that this discussion has not settled the matter. As for the conversion of one motion into another one, or the correlation of forces, I doubt very much if that theory is correct.

SECTION I.

Artificial Dentistry, Metallurgy, and Chemistry.

Paper by T. L. BUCKINGHAM, Chairman of the Section.

IF it was the intention when this Association was divided into Sections, to have the chairman confine his report to new improvements, discoveries, or additions made in the branch during the previous year, and were I now to comply with such intention, I should make my report very short, for I do not think any decided improvement has been made, though there has been a gradual advance.

With the introduction of rubber as a base, and of sectional blocks made by the manufacturers, the old process of mounting teeth on metallic plates was in a great measure discontinued. While the new process was, to some extent, an improvement on the old, it prevented the advancement which would have taken place had it not been introduced. It requires much skill and nice workmanship to mount a set of teeth on a metallic plate; and when the teeth have to be carved, burned, and ground to fit, and arranged to give the proper expression to the face, it requires more than ordinary skill to perform the task properly. Teeth are now manufactured in quantities, and all that is required of the dentist is to select such as will come nearest to suiting the case. The fitting to the plate is dispensed with; in fact he does not want them to fit closely to the gum, because the rubber will fill the space. All he has to do is to make close joints and finish smoothly. He may vary the color and size for the different cases and make some a little longer or shorter than others, but they all have the same regular form and look as much alike as shoes, hats or other articles of dress that are sold in the stores.

Natural teeth vary in shape, size, color, and arrangement. If you were to examine all the mouths in this city you could not find two exactly alike, and one of our objects in inserting artificial teeth is to imitate nature. It is therefore evident that teeth made in sectional blocks and arranged as they have to be in regular order cannot imitate natural ones.

Why cannot artificial teeth be made to resemble natural ones? The shape, size, color, and arrangement are under our control. To obtain the best results we must not use sectional blocks,—we must have single teeth. Let us see what is within the reach of every dentist who has talent enough to accomplish what he undertakes in artificial dentistry.

First, we have the porcelain composition, which can be made to imitate the natural teeth so nearly that they cannot be told at a very short distance. We have also compositions to imitate the gum near enough to avoid detection. With these we ought to be able to construct teeth that would very nearly resemble the natural ones. Single teeth are also made, very closely resembling the natural organs. In making molds for them the manufacturer selects the best-shaped natural teeth for patterns, and the color is very near like that of good, healthy natural ones. But natural teeth are not always regular in shape, nor are they always uniform in color in the same mouth, and by use they are worn on the cutting edges of the front and the grinding surfaces of the back teeth; so that in a person's mouth of over forty the teeth present a very different appearance from what they did at eighteen or twenty years of age.

As it is our object to represent the natural organs as near as possible, we should grind the teeth off as much as natural ones are worn. The practice is not to grind the teeth on the cutting or grinding surfaces. I say grind them all over if necessary; make them the shape you want; then if the ground surface is polished with pumice on a buff and finished with rotten-stone and oil, a better surface can be made than they possessed when they were burned. Ash & Sons polish their teeth and in doing so give a much more natural surface; so by grinding and polishing we can make single teeth any shape we wish.

In regard to the color, it is sometimes impossible, with all the varieties there are in the depots, to match the color of some natural teeth. By selecting such as have the color of the body of the natural tooth and using some mineral paint, a tooth can be made to match almost any natural one. Porcelain painting is now so common that the prepared colors can be purchased at any store where they keep artists' materials. Forty years ago they painted all porcelain teeth. When first burned they came out as white as beans and of nearly the same shape. They were then painted and burned again.

In setting an artificial tooth alongside a natural one that has been badly decayed and filled, and perhaps is black on the side opposite

the filling, the neck green and the edge blue,—it is impossible to match such a tooth unless we color one. If a tooth is selected of the color of the body of the natural one, ground and fitted to correspond in size and shape, and then painted to match, it may be made to imitate the natural tooth so closely as not to be detected. The painting may be done by any dentist who has skill and taste enough to make a good set of teeth. The mineral colors change very little in burning, unless they are heated much more than is necessary. The burning may be done in a muffle; one of the small furnaces used to make continuous-gum work is the best. If the dentist has not one of these he can use a clean crucible, heating the teeth to a full red heat in an ordinary fire; or they may be burned on a piece of charcoal with a blow-pipe, using a naked flame. All that is required is to heat to nearly the melting point of silver, when the silicious compound with which the paint is mixed fuses and forms an enamel.

After selecting and preparing the teeth to suit the case, the next thing to be done is to arrange them. This requires more than ordinary talent to accomplish properly. Almost any mechanic with a few hours' instruction can put up a set of sectional blocks on a rubber base, and they will be as regular and beautiful as a row of piano-keys; but to make teeth irregular and give them a natural appearance to harmonize with the other features of the face requires the talent of an artist. The dentist should not be satisfied when he sees that the teeth are not too short nor too long, are the right color, not too large nor too small, or that they articulate properly. They may be right in all these essential points and yet have a very artificial appearance. He should take pattern after the portrait painter: commence with the patient present and notice not only the teeth, but all the expressions of the face, and arrange the teeth to harmonize with the features so as to give the best expression to them. A photographer sets his subject in a chair so as to get the best light, places the head in a fixed position and takes his picture. Everybody knows that a photograph gives no expression; it is only a picture of the person when he is in a quiet, passive condition. The portrait-painter will not only give you a picture, but will give expression to it; a little twinkle in the eye or a slight elevation of the lip is transferred to the canvas, so that you not only see the form but also the character of the person. As the artist is not always called upon to paint a beauty or persons of a similar cast of features, so with the dentist. If our patients were all alike in form and expression we might have sets made to suit them. It is not necessary for me to call your attention to the

deformity when the natural teeth are lost. The face is then shortened from one to two inches, the lips fall in and the chin comes up to meet the point of the nose, and every muscle of the face below the orbit is changed. Persons who have lost their teeth cannot smile or give a pleasant expression, their cheeks are wrinkled, they have no lateral motion to the under jaw, and in eating they can only roll the food into masses and swallow it without mastication. In fact they would be horrible to look at if we were not so accustomed to seeing them. A writer who is well informed estimates that there are twenty million teeth extracted in this country every year, and at least eight million of artificial ones made. When we consider the various expressions of feeling shown by the face, and the importance of the teeth in speaking and mastication, we may form some estimate of the necessity of replacing them when lost.

In using single teeth it is necessary to have some substitute for the gum. We have two such that answer the purpose well—the continuous-gum body and celluloid. Continuous-gum work has been before the profession so long and its merits have been so highly extolled that I shall give it not more than mention. It certainly makes the most perfect work when it can be used; but there are objections to it—it is heavy, liable to break, and not easily repaired. It has been in use more than thirty years, during which time it has been tried by many who have discarded it, and its use does not appear to be increasing.

Celluloid, when properly made, answers the purpose well. It is cheap, more easily managed, lighter, can be easily repaired, and may be made to imitate the natural gum very closely. It is not necessary to give the chemical composition of this compound. It is known to be made from gun-cotton by adding camphor and some oxide of zinc; a little vermilion is also added to give it color. It softens to a doughy consistence at a temperature of 300° F., when it may be pressed in molds to any shape.

The first step in arranging the teeth is to obtain a base-plate. Wax is used, but it is too soft in the mouth. Wax and paraffine in equal parts, colored with alkanet root make a good plate; gutta-percha and modelling compound are also used, but the best and most satisfactory is a metallic base-plate. It is not much trouble to make, and it will retain its shape and will show if the impression of the mouth is correct. Here we should stop until the plate is a satisfactory adaptation. When this is accomplished we may arrange the teeth on it by means of paraffine and wax. If the operator will take the

trouble he can make the case just as it is wanted when finished. The wax is covered with tin foil, worked into place with a burnisher. Rugæ may be made in the wax on the palatine part so as to give a more natural feel to the tongue. The tin foil may be stippled to give a granular appearance. By having the wax covered with foil on both the outside and the palatine surface and making the case on a metal cast, it will require very little finishing after it is pressed.

Single teeth mounted on a gold plate, using celluloid to attach them and to form the gum, makes one of the most satisfactory cases for both the operator and the patient.

In working celluloid many fail from not having a suitable apparatus and from not taking sufficient care. It will soften at 212° F., and it may be pressed into shape at that temperature by using sufficient force. I have known it to be worked with boiling water in an open vessel, but it is only forced into shape and then has a tendency to spring; such cases get out of shape very soon. I have some specimens to show the effects of different temperatures on it. It should be heated to a temperature of 300° F. At this point it is in a doughy condition and may be molded into any form, with the certainty of its retaining its shape when cold, and with no liability to spring.

SECTION 1.—Continued.

The Ill Results Produced by the Use of Artificial Dentures upon Plastic Bases.

PAPER BY WILLIAM H. DORRANCE, OF THE SECTION.

IT is a sad and incontrovertible fact, that that disease which comes frequently under the notice of the dentist, known as dental caries, is universally prevalent, and is thought by careful observers to be on the increase. The loss of teeth resulting from other causes, particularly calculus in its various forms, is also appalling.

Though much painstaking effort on the part of members of the profession has been directed to the diffusing of practical information relative to the proper care of the teeth and the pressing need of their salvation, much more has been said and done that is not only fallacious and harmful, but, in view of the high importance

of each member of the oral apparatus to the human economy, absolutely (though perhaps ignorantly) criminal. That the public at large, even highly intelligent and cultivated portions of it, are apathetically lacking in appreciative knowledge of the important functions of the teeth, and consequently indifferent to their loss or efficient restoration, is not surprising, when it is taken into consideration that the great majority of those who, by reason of their claim of membership in the dental profession, should know, are yet to become properly educated in the matter.

While the representative portion of the profession has been steadily advancing in the treatment of diseased conditions and in a knowledge of therapeutics, and may be said to be making headway in oral surgery; while it is becoming—nay, has become—justly noted for superior excellence in all operations upon the natural teeth, it has not made corresponding advancement, but has rather retrograded in the equally important department of dental prosthetics.

The reputation of a person is determined by his acts, and that of a profession is established by the abilities and activities of its members. In the rapid stride of those who are (by the process of "natural selection") placing themselves in the front as operative specialists, and of those whose love for the work has led them to devote themselves to the investigation of proximate causes, there has been, it is to be greatly regretted, a noticeable lack of any thought or care for prosthetic dentistry, with a consequent debasement of it, and desire of divorcement from it. On the other hand, the short-sighted and time-serving indifference with which assistants have been chosen, or so-called students admitted to the offices of reputable practitioners, and without subsequent preparation or direction of value and with scarcely a glance at a text-book during the few short months of their stay, have been carelessly allowed to launch out as members of the profession (and come to be recognized as such by the too indifferent and pre-occupied public), has been the means of bringing to the ranks of the profession the men who, as numbers go, constitute the bulk of it, and into whose hands prosthetic dentistry has been largely allowed to fall. These, in the exigencies of the matter, have no thought or care for the advancement of the profession, or the amelioration of the condition of suffering humanity, save as it is to the present interest of their pockets. And hence we have a profession that, whatever its claims to advanced standing, has in its representative membership been gradually losing sight of, or, perhaps, has rather lost interest in observing and investigating not only the me-

chanical, but also the physiological and esthetic principles involved in the construction of an artificial denture, which shall as perfectly meet the requirements as it is possible for human skill to provide, and consequently has neither the skill nor the judgment to properly advise patients in the matter.

But there are other causes for failure of advancement in dental prosthetics. With the introduction of plastic (or vegetable) bases for the support of artificial dentures came a new era. Those who were previously unable on the score of expense to have lost organs replaced, and those who valued absence of pain rather than the presence of natural teeth, began to think that they too might have artificial substitutes, and thousands of such have been supplied with substitutes upon plastic bases.

Dentists who had been in the habit of putting much skill into the construction and fitting of gold and other metallic plates allowed the ease of manipulation which was soon acquired, and the lowness of cost of rubber work to mislead them into what has proved the error of recommending it to their trusting patients as the best for them. That same fatal ease not only led to vastly inferior work, but to the indiscriminate and greater loss of valuable natural teeth, millions of which are now annually sacrificed to be replaced with teeth upon plastic bases. One of the results of this growing evil is that the great majority of those whose increasing reputation for professional skill should have made them especially solicitous to give their patients the best of advice and service, have gradually been relegating this important part of their duty to the inefficient care of those whose only apparent claim to be called dentists is that they can make rubber or celluloid plates.

It is true there are those whose best efforts have been and are devoted to elevating prosthetic dentistry, and their names are shining marks, but quite like angels' visits.

As a natural sequence of this apathy in regard to, and manifest desire to get away from prosthetic dentistry, on the part of what is termed the representative part of the profession, it has been heavily handicapped in its strife for higher life and position by dragging the dead-weight of those whose best efforts only serve to degrade an honorable profession to a plane below that of a reputable trade, abundant proof of which is seen in the efforts of what is to-day known as "cheap" dentistry.

Having noticed thus briefly what the introduction of plastic work has done for the profession, let us consider if there is anything in

the use or abuse of these bases bearing upon our duties to our patients as conservators of their health and physical well-being.

The qualities which principally have brought rubber and celluloid into such general and almost exclusive use may be very briefly stated: Rubber is easy of manipulation and cheap. Celluloid is inferior to rubber in these respects, but has the fickle superiority of better color. The first quality has made it possible for the veriest tyro (whose name is legion) to make what can only by an extreme stretch of courtesy be called a set of teeth. The second has made possible to thousands (whose sore need did not by any means give them the knowledge on which to base sound judgment) the possession of an inferior substitute for the priceless natural organs now lost. Let us see if this multitude have been defrauded and injured in this attempt to aid them, and first briefly name the structures involved in the support of an artificial denture. In the edentulous mouth we have the superior and inferior maxillary bones, with their alveolar processes and foramens of exit for important nerves and vessels, their places of insertion for the muscles of mastication and expression, and their investiture of soft tissues with their ducts and glands; the mucous membrane with its delicate glands. It is essential that the saliva, with so much depending upon the healthy condition of its components be considered, and, where there are still left some of the natural teeth, their susceptible structure and attachments must also be taken into account.

We must inquire into the uses of the organs we seek to replace, not pausing to admire the infinite skill and wisdom manifested in the arrangement of the perfect set of natural teeth; into mastication, noting the necessity of the grinding action to the excitation of the parotid glands; insalivation, only well accomplished when the food is thoroughly masticated; vocalization or articulation—no part of the vocal apparatus being more essential to the distinct utterance of speech; we must notice the regulatory effect of a full denture upon the respiration; and also the support of the contour of the face by the teeth and their investing processes, and the important relation of the teeth to the physiognomy.

What are the principal changes that take place as the result of the loss of teeth? If that loss is partial, there is a corresponding loss of grinding and occluding surface, the perfect arch is broken, and the teeth left, having lost the support of their fellows, soon change position, and perfect occlusion is destroyed; ease and distinctness of enunciation are seriously impaired; and the absorption of the alveolus allows a corresponding sinking of the face.

Having thus briefly glanced at the principal structures and functions involved, let us see what the effect of introducing a denture on a plastic base will be. Leaving aside the mechanical irritation due to illy-fitted plates with the common deep chamber and ordnance map of ridges, and, with the assertion that it may be considered an axiom that under like conditions it is impossible to secure as perfect a fit with a plastic or a cast plate, as with a swaged plate (inasmuch as the perfectly shaped plaster model does not represent the varying texture of the mouth), let us at once consider another very serious objection to plastic bases.—that due to non-conduction. It being an essential condition of health that the heat constantly generated in the body shall pass away from its surface, its complete retention must result in death, and partial retention induce a greater or less pathological change of the part or surface involved. As the mouth is used for the reception of food and for speech, so far as thermal change is concerned it must be considered a heat-liberating surface. With the use of a vegetable plate comes a pathological condition due to non-conduction. The surface covered becomes congested, and the mucous membrane puffs up as though it were blistered; there is paralysis of the nervous supply. The mucus assumes an acid reaction, and the mucosine is coagulated and is a source of further irritation, and there is an abnormal rapidity of absorption of the alveolar process and the bone. Where natural teeth are present they soon become unhealthy and sensitive, and in spite of the utmost care the surrounding gums lose their integrity, and gradually the teeth go. The vitiated condition of the secretions soon becomes noticeable by the peculiar odor, and the plate becomes coated, and even with constant care it cannot be kept in a bearable condition.

In 211 partial and full cases observed, where upper plates upon plastic bases were worn, 165 of which were rubber and 46 celluloid, 47 per cent. have shown these effects in an aggravated form. In 91 per cent. these effects were marked, and in the remaining 9 per cent. there was no noticeable ill result. In three cases there was marked sloughing of tissue, with necrosis of bone. By estimation (as there was a failure to keep a complete record) the average time of use was two and two-thirds years. It is true that in many cases there was the complication of mechanical irritation due to the outrageous means used to secure retention of the dentures. In the observation of something over fifty lower cases (of the same patients), while some of the effects produced by the upper plates have not been quite so marked, a careful comparison with cases where metal plates or none

at all were worn, has led to the belief that one marked effect has been the same, viz., greatly increased absorption. In many of these observed cases the congested condition extended beyond the borders of the denture to the throat, and was doubtless complicated with general pathological conditions.

Now, without going into a statement of the difficulties—nay, impossibilities—in the way of accomplishment of esthetical results with rubber, or into the short life of the same results as apparently secured by celluloid, and without discussing the inherent tendency to uncleanliness, let us ask if the same effects are found as the result of the use of dentures based upon some conducting material. Of the 211 cases before noted, 126 have been replaced with metallic plates after such treatment as might be available. Of this number of cases enough have been under observation to give a fair estimate of the value of the change, and the least that may be said is that the improvement is marked. In many of them the return to health has produced such a shrinkage of the mucous membrane and the gums as to necessitate the refitting of the case in a few months' time. In all cases the patient has expressed a greater or less degree of appreciation of and gratification at the pleasant change.

These observations, show the necessity of conduction, and so far as they go, prove that vegetable bases are injurious and should not be used, and bring us squarely to face the fact that if we would do justice to those of our patients who are in need of artificial substitutes, we must see that they are intelligently supplied with such as will do them the least injury and secure the best results; and the profession certainly places itself in a very bad light before its own conscience, if it refuses to take cognizance of that branch of its activities which clearly cannot with any show of justice or shadow of excuse be cut away from its perfect whole without seriously crippling its integrity.

DISCUSSIONS.

Dr. Horton: Is the coloring matter that is used in celluloid the same that is used in red rubber?

Dr. Buckingham: Yes.

Dr. Horton: What is the ingredient used to color black rubber?

Dr. Buckingham: Carbon.

Dr. Horton: Is there any poisonous material in that?

Dr. Buckingham: No.

Dr. Horton: What is the difference in the transmission of heat through rubber and through celluloid?

Dr. Buckingham: I do not know. I have never tested the conducting power of the two. I suppose probably they are nearly the same. In vegetable matter there is not much variation in the conduction of heat. There would not be sufficient difference to take into account.

Dr. Hurtt: Dr. Morgan asked the question of Prof. Buckingham, during the reading of his article, if this celluloid could be taken from the metal casts if the undercuts were very deep? I was told by a gentleman who had made several hundred cases of this kind, that it can readily be done when the cases are made with plain teeth,—that you can spring them off and the celluloid will return to its original position or shape without change of the plate or the arrangement of the teeth.

Dr. Buckingham: If you should have such a case, if you put it in water and heat it to the boiling temperature you can remove the plate. If you are going to use block teeth, make the base of rubber, but if you are going to use single teeth for a full set make it of celluloid.

Dr. Morrison: Is there any mode of manipulation by which the integrity of the color of celluloid can be preserved?

Dr. Buckingham: The color of the plates recently made has stood well in ordinary mouths. A person who smokes will color rubber or any other substance unless it be a metallic plate. Some years ago some celluloid put on the market was not good, and the material got into bad repute.

Dr. Atkinson: I wish to speak a few words with regard to principles, and then to present you the discovery that relieves us of all difficulty attendant upon misfits and incompatibility of artificial bases. It is known that if we want to clothe a human body we have to put a non-conductor upon it to prevent the radiation of its normal heat. If we want to substitute any portion of the lost tissues of the body, it is desirable that we have that substitute conform as nearly as possible in conductive or thermal and nutrient currents to the tissues themselves. There has been a discovery of a base made by George F. Reese, which has been of the greatest satisfaction to me; and those who have used it in cases of regulating pronounce it the best base for that purpose they have ever known. I have worn everything in my own mouth that has ever been presented for artificial teeth, and I give you my word that this is the

only thing that I could forget while wearing it, the only thing that has seemed to be acceptable to the tissues, so that I did not know anything about its being in my mouth. This has cost a great deal of labor and a great deal of experiment, the difficulty having been that we were so determined to have a high karat of gold. By having too much gold we found that it became brittle. We have finally learned the proper proportion to secure the best results.

Dr. Robinson: I have a lining for celluloid or rubber plate that I wish to present to the Association. Two years ago I found that I was losing my mouth from inflammation and absorption from wearing black rubber, and I went to work to see if I could remedy the difficulty. I finally produced an alloy composed of platinum and tin, with a very small portion of gold, that would adhere to the plate as well as paint does to wood—I give you this illustration because it is the best I can give. I have worn it in my mouth nearly two years. This metal being fibrous has the property of mixing with the plate when the latter is warmed in such a way that it cannot be removed and does not wear off. During the last year, since I have been wearing in my own mouth plates lined with this material, I have examined, perhaps, two hundred mouths in which vegetable plates have been worn, and in almost every one of them there were large patches that were inflamed and red and soft. This is a thing that is, perhaps, worthy of your attention. I found also that this metal would weld to gold, and so I substituted it in the filling of teeth, and I have some fillings here illustrating how it works. You have in this a material that will preserve the walls of the teeth as well as gold, and you may veneer it with gold if you desire. This material will not soil or grow dark in the tooth, and will eventually take the place of amalgams, and is most excellent for filling the deciduous teeth and for starting fillings, instead of retaining-points. It will stand and do good service in all cavities with surrounding walls, and in most cases, when covered with gold, will make a filling as good or better than gold itself.

Dr. Hurtt: I have been made to feel this morning as I have not for twenty years the degrading influence of what has been going on. I do not generally use very strong language, but I do wish to speak my mind here to-day on this subject, and on the proceedings at this time. I came to this Association expecting to witness the transactions of the most eminent men of this country. I expected to hear principles discussed, and to hear reports of the best things in practice that had been devised by our best men for our benefit and

for the benefit of our patrons and the rising dental students. What have we witnessed here?

THE PRESIDENT: I believe I must call the gentleman to order.

Dr. HURTT: I appeal to the American Dental Association in order that I may proceed on this subject.

THE PRESIDENT: I decide that the gentleman is not speaking upon the subject of artificial dentistry.

Dr. THOMAS: I move that Dr. Hurtt be allowed to be heard.

The motion was agreed to.

Dr. HURTT. I have been taught from the time that I entered a dentist's office not to engage in anything in the direction of mechanical dentistry that would degrade the profession. I have been taught that no man had a right to bring mechanical appliances or patented methods into an association of this character, to press their purchase upon the profession. It pains me when I find a gentleman, like Dr. William H. Atkinson, of New York City, one of those to whom I have looked for the best things in dentistry, one of the great lights of our profession in this country, coming here with circulars setting forth devices that they have introduced and patented, and now advertising and urging their claims, as has been just done before this Association. Are we a committee to sit here and judge of dental patents and materials, and to put the seal of the Association upon them? This is what I object to. What are we to expect from students if such things are allowed here? Suppose a young man from Kansas should come here with a similar article, and, under similar circumstances, attempt a thing of this kind; would the President of the Association permit it? Would the American Dental Association allow it? There are professors in dental colleges here to-day, who have taught that such practices are unprofessional, and in many instances they would not associate with those who do this kind of business.

In this great representative American Dental Association, the teaching and example should be elevating, not degrading, and such appliances or materials, if on sale, should be placed before the members of the Association through the proper advertising channels.

One thing in regard to celluloid. I have made a number of celluloid plates, and find that as a rule, men who use alcoholic liquor, cannot wear them. In several cases, I have seen from one-half to two-thirds of the plate eaten off within a year's time by the use of alcoholic liquors.

I thank you for the privilege you have accorded me.

Dr. Buckingham: I did not bring anything here to sell; I simply showed you a model and a method. I do not sell celluloid. I have a right to speak of the properties of celluloid as much as others to speak of the properties of gold. It is no humbug. I do not bring any secret compound here to show you. I simply wish to give the young men here some instructions in the use of a material that is in use. I do not say that it is the best material in use. I do not come here with quackery, or any secret process. I do not want to be classed with the men that the gentleman speaks of. I disclaim any thought of urging anything in which I have any pecuniary or proprietary right. The others may take care of themselves.

Dr. Hurtt: I did not, in my remarks, have any reference to what Professor Buckingham had said or done. I merely wished to call the attention of the professors who are here to this subject, hoping that they might impress upon their students the right principles governing this question. I merely wish to assert what I believe to be the fundamental principles underlying these matters, which have been taught by many good men in our profession, and I think ought to be handed down.

The President: In explanation to Dr. Hurtt, the Chair would state that he was under the impression that these gentlemen who spoke and brought these things before the Association, did so on the recommendation of the committee of the Section; otherwise he would not have permitted it.

SECTION III.

Dental Literature and Nomenclature.

Nomenclature and Terminology.

Report by W. H. ATKINSON, Chairman of the Section.

IT has been the object of this series of reports to exhibit the application of Universology and Alwato to the purposes of general scientific Nomenclature and Terminology; and to illustrate the new facilities which these recent scientific discoveries place at our disposal. It must always be borne in mind, that new things are new, and that it is not until their air of strangeness is worn off and familiarity takes the place of novelty, that we can rightly appreciate the value of fresh contributions to our store of knowledge. The object of the present report is to carry a step further forward the same general purpose.

Still, while Universology and Alwato are adapted to the furnishing of technicalities scientifically constructed for every branch of science, it is mainly the animal series of biology to which our attention is being directed in these reports; and within this, chiefly to human-body-lore; and within this, predominantly, to tissues or histology, and to this minor branch of living-things-lore especially as it converges upon the structure of the teeth and the particular objects of this Association. Universology, as such, is the science of universal classification; and Alwato, on its scientific side, is the science of the natural and appropriate namings for all the results of classification, in whatsoever department.

Within the animal series it is our well-known inheritance from past scientific discovery, that development passes through a succession of stages, from the more simple to the more complex. To Louis Agassiz we were, at no distant date back, indebted for the additional and immensely important discovery, that the successive stages of the development of the fœtus, embryologically investigated, repeat, analogically, the successive stages of the development of species in the general animal series—so that we have two parallel

series, each reflecting the light derived from its study upon that of the other; and now we have a third and similar discovery, by Stephen Pearl Andrews, to the effect that the serial development of the sounds of the human voice constituting the basis of language is another parallel series of phenomena, repeating the other two series just specified with such accuracy as precisely to apportion the sounds produced by the voice to the classes of objects requiring to be named.

The idea, then, at bottom, is that, as the entire body of nature is a grand organismus (or collection of organs), of which the particular minerals, plants, and animals (and their genera and species), and especially the human body, as the superior animal product, are the specialized organs; and as the human body is a grand organismus, on a smaller and finer, but still on a repetitory scale, of which the organs (tissues and parts) repeat and correspond to the plants and animals, or to their seriated genera and species; so, in fine, the human mouth (throat, nose, and ear—"the organs of speech") is a minor organismus, the parts and touches of which in the production of the vowel- and consonant-sounds constituting language are the particular organic products; which, again, repeat, in number and arrangement of distribution, the organs (tissues and parts) of the human body entire; and, further back, the organs of universal nature, of which the human body itself is merely one.

And further, as the result of this repetition, in these three narrowing concentric circles of organization—first affecting nature at large, then affecting the human body as a reduced picture of the whole natural world, and then affecting the mouth and its series of sounds, as a miniature of the entire body—the sounds of the human voice are precisely adapted, by nature herself, in number and arrangement, to *re-present* the number and arrangement of the parts of the human body; and so the fact becomes revealed that nature has, from the first, provided science with the true and only proper system of technicalities for every department; quite in the same way as nature has provided the laws of music, which, nevertheless, had to await their discovery by human observation to be constituted into the actual score. So, it is now discovered that the true laws of language have always been latent in the organic structure of the organs of speech; and Alwato is the one language for the whole world, which is to result from the full discovery and practical co-ordination of those laws. But, first and foremost, Alwato tenders its services as a system of scientific technicalities. Such is the connection which it has with the purposes and labors of Section III. on Nomenclature and Terminology.

Phonetics, or phonology, is the name for the science of sounds, especially as involved in the production of human speech. Upon the better understanding of phonetics has been founded the art of (steno-) phonography, or the art of rapid writing, for reporting and allied purposes. These sounds are all produced by contacts of different parts of the mouth. The deftness of these touches, and the purity and strength of the resulting sounds, are greatly dependent upon the teeth. Here is the point of connection between the science of sounds and of language entire with dentistry. Common experience teaches that the ignorance or inexpertness of the dentist often affects the voice of the patient disagreeably. This can only be properly guarded against by some knowledge of phonetics; and no auxiliary studies could be more charming and useful for the profession than the studies of phonetics and phonography. As phonography involves phonetics, any ordinary text-book of phonography would do to begin with. The field of the phonetician, of the Alwatoist, and of the dentist is, in common, the human mouth. It was the connection between phonetics and dentistry which was pointed out in the discussion last year by Dr. Waters.

But the step in advance of mere phonology, which Mr. Andrews has made, is the discovery that all the sounds of the human voice, made in speaking all languages are a limited number; that they are arranged into definite classes by nature, and that this arrangement is such that each sound or class of sounds exactly corresponds with a given tissue, organ, or aspect of the body, as a whole; so that nature herself has provided us with precisely the one, and the only possible right and adequate system of nomenclature and terminology.

But even more than this, and perhaps more important, is the fact that this mutual natural adjustment of a major organism—the human body, as the one grand organ for the production of the functions and actions of the human body,—and a minor organism—the human mouth, as the one minor organ for the production of the sounds or utterances of language,—are so completely adjusted to each other throughout, that each may be studied through the other; each mode of study correcting or proving the other, somewhat as we do a sum in arithmetic, and then "prove it" by the inverse method; that is, in other words, the arrangements of the tissues of the human body may be studied not only by direct inspection under the microscope, but also in so seemingly remote a field as that of the arrangements and meanings of the vowel- and consonant-sounds of the human voice.

And so, while Carl Heitzmann, with other microscopists, is rapidly

enlarging the field of knowledge in our domain by direct inspection, Stephen Pearl Andrews has devised and is bringing to our attention a new sort of *mental* microscope, which is applicable, in another sense, to the same department of investigation; and if the chairman of this Section has any special sphere of merit in the premises, it is, perhaps, mainly, that his own studies and scientific pursuits have been of a nature to enable him to understand in some measure both these men in the great distance and diversity of their pursuits, and to recognize the importance to our profession of our laying hold of and utilizing conjointly the results of their important labors.

We will commence our practical study for this year with the following two words and their definitions:

1. Bau,ski (pronounced bough-skee), science of all inorganic, unliving, non-living, not-living, or dead things (excluding the "*died.*"—Elsberg).
2. Vau,ski (pronounced vow-skee), science of all organic or living things (including the "*died.*"—Elsberg); Biology.

The latter of these two sciences has for some years past come to be pretty extensively known as biology, which includes and covers the ground collectively of botany, the science of vegetable life, and zoology, the science of animal life. (This has nothing to do with the popular use of biology to denote a branch of mesmerism). For the former of these two sciences (bau,ski) the scientific world has been until recently without any distinctive name. In the "Basic Outline of Universology," Vau,ski is called Organismology, and Bau,ski, Inorganismology. Hæckel, availing himself of the Greek negative prefix *a-* (alpha privative) has named them Biology (Vau,ski) and A-biology (Bau,ski).

The consonant-sound *b* is the thick, dull, heavy, concrete, and relatively dead lip-consonant sound; non-vibrative, and, therefore, non-vital; the *v* is also thick, dull, heavy, and concrete, but vibrative (by the tremble of the lower lip as pressed upon by the upper teeth), and, therefore, vital or *viv*-id.

The diphthong au (ah-oo) is used to summarize the eight vowel-sounds and the four leading diphthongs, including itself—in a word, the whole vowel scale. It breaks up, therefore, into twelve special vowel- (or diphthongal) sounds; and, accordingly, there are twelve sub-sciences named by the vowels. We may, however, for our present purpose, omit the diphthongs, and we may also set aside any further present consideration of Bau,ski. We shall confine our attention, therefore, to eight variations or subdivisions of Vau,ski (Biology).

The eight subdivisions of Biology now in question, depend upon the meanings of the eight vowel-sounds. The following tabular views will conduct us to them, thus:

I.

Pronunciation of the Eight Vowel-sounds.

i,	pronounced	ee, or like i in mach*i*ne.
e,	"	a, or like ai in p*ai*n.
a·,	"	a flat, or like a in m*a*re.
a,	"	ah!, or like a in f*a*r, f*a*ther.
·u,	"	uh!, or like u in c*u*rd.
·o,	"	aw(e), or like o in n*o*r.
o,	"	o, or like o in n*o*.
u,	"	oo, or like (nearly) u in r*u*le.

II.

Meanings of the Eight Vowels.

i, centre, THING, entity (ent-, ont-) . . . . . POINT.

e, side, SIDING OF THING, *by which it is adjoined to other thing;* whence, reciprocally, side-to-side-ness, which is RE-LATION (Lat. re- 'back' or 'inverse' and lat-us 'side'); so, side-ness and re-side-ness; branchingness, Gr. phyllon 'branch;' distribution into 'branches,' 'classes,' 'genera,' 'species' . . . . LINE.

a·, flatness ("flat a"), as palm of hand, sole of foot, bottom or seat of body; plain, level or surface of the earth; scale, degree, lift, loft or story of any kind; transverse cover, top, cap, or roof; *horizontality*, CARDINALITY . . . . . SURFACE.

a, thick-th, heap, cumulation, mass, brawn; richness, fat, exuberance, SUBSTANCE (what stands under) and super-stance (what stands over); dimension of height-and-depth; up-and-down-ness; verticality, *perpendicularity;* whence order of ascent and descent, as of an upright column or an edifice, from bottom to top and, inversely, from top to bottom; ORDINALITY . . . SOLIDITY.

·u, flux, fluidity, liquidity, current, canal . . . . . TIME.

·o, circumstantiveness, all-aroundness, *solidosity*, tri-dimensionality SPACE.

o, presentment, appearance, visual forms; (Greek eidos); pro-form —Hæckel; spectro-phenomena . . . . . FORM.

u, inclination, mechanism; tendency, procedure, proclivity, movement, per-*form*-ance; mechanical phenomena . . . . . FUNCTION.

III.

The Eight Grand Sub-sciences, According with the Vowels.

I,ski (ee,skee), Ontology, science of thing and things.

E,ski (a,skee), Relatology, science of relations between or among things; classification-lore.

A·,ski (a·,skee), Cardinology (cardinarology), science of basic outlay, plan, scheme, or quasi-plan, in the organization and function of the universe or any part of the universe; transcendental science; as, Oken and Gœthe were called "transcendental anatomists" (applying philosophy in science), as contrasted with Cuvier, who was an ordinary anatomist, or an anatomist taking the ordinary or common-place views (an,a,ski,po).

A,ski (ah-skee), Ordinology (ordinarology), ordinary, every-day, usual science, as contrasted with transcendental speculation, views, doctrines, or demonstrations; substance-lore, hylology.—Elsberg.

·U,ski (uh-skee), Chronology, time-lore, distribution in time, successively, or by succession.

·O,ski (aw-skee), Chorology; space-lore, distribution locally or in space, simultaneously or by co-existences.

O,ski, Phenomenology, appearances-lore; classification by presentments or visual forms; pro-morphology; morphology.—Elsberg.

U,ski (oo-skee), Mechanics; dynamology.—Elsberg.

If, now, we prefix the consonant-sound *v* with its vibratory, vivid, and vital character, to these vocal discriminations, we confine their otherwise unlimited and broadly philosophical extension to the specific range of living objects, and the same discriminations are then repeated as departments of biology, or sub-biological sciences, thus:

IV.

The Eight Grand Departments of Biology.

Vi,ski (vce,skee), Bio-ontology, the direct study of living beings as individual objects.—Hæckel.

Ve,ski (vay,skee), Bio-relatology, phyllology.—Hæckel; the study of races, species, genera, etc.; the classification-lore of living objects, at large; ground-form, or schemative outlay-lore; theory of 'type-forms' or a 'nature of things,' as the basis of the order of being (and here of living being), biological physio-philosophy.—Oken, Gœthe, Richard Owen.

Va·,ski (va·,skee), Bio-cardinology; transcendental or sciento-philosophic treatment of biology; the general principles rather than the particular details, "general-abstract."—Comte, Spencer, Hæckel, etc.

Va,ski (vah,skee), Bio-ordinology; the ordinary or common scientific examination of living objects; the particular details rather than the general principles; special-concrete.—Cuvier; bio-hylology.—Elsberg.

V·u,ske (vuh,skee), Bio-chronology, science of the distribution of living beings in respect to their succession in time; paleontology and neo-ontology, etc.—Huxley; developmental, biogeny.—Elsberg.

V·o,ski (vaw,skee), Bio-chorology, science of the distribution of living beings in respect to their simultaneous existence, or co-existence, in space (or locally).—Huxley; existential, biography.—Elsberg.

Vo,ski, Bio- (pro-)morphology, science of the configurate presentment, form, shape, appearance, or visual contour of living beings; general descriptive biology, whether of the individual or of the species—often substituted therefore for the broader designation, Vau,ski.—Hæckel.

Vu,ski (voo,skee), Bio-dynamology.—Elsberg; bio-abstract-concretology or mechanology.—Spencer.

The term ontology, usually confined to the most recondite department of metaphysical philosophy (i,ski), is introduced into natural science, and especially into biology (vi,ski), by Ernst Hæckel, the distinguished German scientist, who opposes to it phyllology from the Greek phullon, "a branch," for the science of the class or race as contrasted with the direct study of the individual living object. There is a great objection to this latter term for us English-speaking people, from the fact that to the ear it would sound the same as philology, the science of language. If we were to adopt it, we should, I think, retain, exceptionally, the Greek *u*, in the place of the usual English substitute *y*, making ph*u*llology; but bio-relatology is far better; best of all, the Alwato, Ve,ski.

The adjective "transcendental," like the noun biology, has usually, also, been consigned to philosophy; but "transcendental *science*" is a term freely employed by Hickok; and for a time, anatomists like Oken and Gœthe, who talked of type-forms, or an ideal plan of structure back of the actual anatomy, somewhat like Plato's 'ideas' back of all real things, the ghost, the formative principle which presides over the weaving of the tissues, were known in Europe, in the last generation, as "transcendental anatomists." This point of view is a very important one, and sufficiently distinct from ordinary scientific methods to deserve a distinct designation. This is bio-cardinology, bio-cardinarology, or more simply Va·,ski.

The antithet of Va·,ski is Va,ski, the ordinary, palpable, common, or substantial branch or method of biology—bio-ordinology, bio-ordinarology, or bio-hylology (Greek hulē, "substance"). The cardinary sphere of things is much talked of in Universology, and is transcendental, and so contrasted with the ordinary sphere.

The remaining four of these eight grand branches of biological science are sufficiently characterized in the tabular exposition made of them above. The terms hylology (substance-lore), morphology (form-lore), and dynamology (force-lore), have been introduced and partially rendered familiar by Dr. Louis Elsberg, through his "Classification of the Sciences." His dynamology is virtually Spencer's abstract concretology, and both are mechanical science, in the widest acceptation of the term. To Elsberg also we are indebted for the systematic introduction of the prefix bio- for the departments of the science of living objects, and abio- for those of the science of unliving objects.

It will be seen, therefore, that what is new here is, especially, the bringing of these various discriminations together in this scale of eight, allying them with the meanings of the eight vowel-sounds, and so evolving their Alwato namings—in which the differences of the meanings of the sounds occurring in the names precisely accord with the differences in the aspects of the science named.

We are now prepared to set aside from our present range of investigation all these eight great biological sciences, except the first (Vi,ski), bio-ontology, the direct study of the individual living object; and to enter, as it were, *in*side of it; and to distribute its interior parts, *by a re-application of the same principles of distribution* which we have previously applied in the *out*side way, to the sciences themselves. It is as if coming from the study of whole numbers in arithmetic, we come at length to the consideration of the single unit, and its division into fractions, and then discover that the same numerical laws which we had applied to whole numbers are equally applicable to the fractional parts of the unit down to infinitesimals. So that the law of distribution repeats itself, or appears first outside, or objectively, and then inside, or subjectively, of the sphere of universal things, but here specifically of living objects, externally considered, or as among themselves, and then internally, or as among the several parts of the individual object. For this purpose we have only now to prefix the syllable vi-, to designate the domain, and then to use the same vowels and syllables which we have previously employed, thus:

Vi,bo (vee,bo), a living individual body (with its career).
[Bi,bo (bee,bo), a not-living individual body.]

Or, more definitely expressed:

Vi,bodo (vee,bodo), a living body, more specifically described.
[Bi,bodo (bee,bodo), a not-living body, more specifically described.]
Vi,bo(dō)b,io,ski, anatomy of living objects.
Vi,bo(dō)v,io,ski, physiology of living objects.

See close of last year's report. Huxley has shown that there is an anatomy and a physiology of not-living objects, as well as of living objects.* For these the prefix is bi-, in the place of vi-.

Abridged or Contracted Expressions.

Bau,ski (bah,oo,skee), inorganismology, *Abiology;* science of not-living things.
Vau,ski (vah,oo,skee), organismology, Biology; science of living things, and

* Lay Sermons, p. 237.

VI,BAU,SKI (for vi,bodo,b(au)io,ski), anatomy (of living things), and
VI,VAU,SKI (for vi,bodo,v(au)io,ski), physiology (of living things).

But we come now to the fact that livingness and not-livingness, are first connected and then inter-commingled with each other. The living lives from the *died*, which is its pabulum, and then dies, and so *becomes* the *died*, and again the pabulum of other living things.

So within the so-called not-living, there are everywhere evidences of life; and within the so-called living there are portions of relatively dead matter.

"Nothing that lives is alive in every part. The substance of every living thing consists of three parts:

"1. Nutrient matter or pabulum.

"2. Germinal matter, or bioplasm.

"3. Formed [and now again relatively dead] matter, or tissue, secretion and deposit." *

The capacity of Alwato to thread all these intricacies and to furnish the proper meanings for whatever exists must also be made to appear, for example, as follows:

1. Vi,au,ma, componency of living objects (pabulum in the wide philosophical sense); all the materials and requisite conditions of living beings necessary to be wrought into their constituency, as their substance or stuff (*a*), the space they occupy (·*o*), the time they endure (·*u*), etc.
2. Vi,vi,bodo, now living body.
    1. Zhi(vi)bodo, plant or vegetal object (or part of do.).
    2. Zi,bodo, animal object (whole or part).
3. Bi,vi,bodo, or bi,vi,to (-to for bodo), *died* living thing; a properly living thing from which life has now departed, as fossils, carcasses, and effete matters of all sorts.
    1. Di,vi,to, an at present dying object; moribund.
    2. Ji,vi,to, a recently or just-now living thing, a corpse.
    3. Gi,vi,to, a gone past or ancient dead-living thing; a fossil—paleontological.

1. Vi,vi,au,ma, pabulum proper, dead or died food of now living beings (or of dead living beings in their time).
2. Vi,vi,vima, germinal matter, protoplasm, bioplasm, bioplasson.
3. Bi,vi,vima, formed matter, tissue, secretion, and deposit.

Vivi,v,io,ski, microscopic anatomy, physiology, and hygiene; microscopic biology.

Vivi,vi,io, parenchyma, primary corpuscular mass.

Vivi,ve,io, prosenchyma, prolated corpuscular mass.

(Vivi,)VITO, the plastid.—Elsberg. (Cell, corpuscle.)

Vit,au,ma, pabulum of plastid.

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* Joseph Cook's Lectures on Biology, p. 77.

Vīt,i,ma, granular mass.
Vīt,e,ma, living thread-matter, reticulum.—Heitzmann.
Vīt,a·ma, cell-walls, membraneous parts, etc.
Vīt,ama, vital mass or substance.

This last is the department covered by Heitzmann, Elsberg, Bödecker, Abbott, and other pupils of Heitzmann, in their new scientific investigations and discoveries, which furnish so brilliant an addition to previous histological knowledge. The disposition of the lingual materials which Alwato furnishes for the technicalities of this new field belongs properly to the workers in it. What is here presented is, therefore, merely suggestion.

In conclusion, let us recur to, and re-state, in epitome, the four grand bases of distribution, allied with the first four vowel-sounds, thus:

i, THING (centre), individual. Singuloidity.
e, CLASS (side), species. Pluraloidity.
a·, GRADE (surface), "Place in Nature,"—Huxley. Cardinality.
a, KINGDOM (solid). (Dynasty, state.) Succession by generations. Ordinality.

SECTION III.—Continued.

Report on Dental Literature,

BY J. TAFT, OF THE SECTION.

THE history of the development, growth, and progress of dentistry and the dental profession as given in its literature is, in the main, familiar to all readers and students.

Every one having any special professional ambition or aspirations will desire to know and understand the record of events and the current of the science and art with which he stands most intimately connected. A contemplation of its rise and progress, and of the changes and vicissitudes through which it has passed, will be beneficial, as a knowledge of the past gives stimulus and strength for action in the future; and this knowledge can be gained in an adequate and definite manner only through our literature.

Tradition is no longer to be relied upon as a means of conveying historical knowledge, other and better modes of perpetuating the truths of history having been substituted.

When any particular subject is brought forward for consideration, the first inquiry usually is, what has been written upon the subject, from whom has it emanated, and how has it been presented? and this interest extends not only to what has reference to special and immediate branches of our science, but to those which are collateral as well.

Some things which are usually denominated collateral, really constitute the foundation of our science, and the manner in which these are presented is a matter of much importance to us. Indeed, the literature of any branch of study that can be made tributary to our science is of great importance and interest.

Formerly the study of the pupil and of the practitioner, was confined to the so-called *dental* books; but a great change has been wrought within the last thirty years, chiefly through the instrumentality of dental colleges. Now, the subjects to which the student is required first to give attention are anatomy, physiology, materia medica, and chemistry. And these studies are placed first by private instructors as well as colleges.

It would add much to the strength, progress, and prestige of our profession could its members keep abreast with the general sciences. It may not be practicable nor even possible for him who is burdened with the duties of a large practice to be perfectly familiar with all the scientific topics of the day, but as these subjects are now treated, one may, by careful selection, gain a general and even accurate knowledge much more easily than in former times even under the most favorable circumstances.

Every subject is now more freely and clearly discussed in the periodicals and newspapers of the day than ever before, and these are always easily obtained, so that "he who runs may read," and a ready apprehension of these constant acquisitions to knowledge is promoted by the activity of the present age, so full of competition and emulation.

The general literature of the day, perhaps more than ever before, presents thoughts, ideas, descriptions, and facts in a brief, compact form, rather than in the prolix, verbose, and argumentative way of many of the earlier writers—on scientific subjects especially.

This is pre-eminently an age of paragraphing, a time when men scan books, rather than read them, for ideas and facts. Any subject, to receive attention at the present time, must be presented in an attractive style, full of strong points and pungent effects, and above all condensed to suit the taste of a people who are living at a rate wholly unknown to our forefathers.

The rapidity of movement and the intense activity of the age in which we live have been chiefly instrumental in effecting this result.

Condensation and brevity are elements of English composition more especially, as is shown in translations made into the English from the French or German.

The aim now is, not to invest thoughts or ideas with as many, but with as few words as possible, and hence the growing importance of giving to every word a clear, definite, and as nearly as may be, a fixed signification.

While a much larger number of persons are helping to make the literature of our profession, yet that there has been great improvement is apparent.

The growing desire at the present time for a more extended and higher education, with the finer culture which must result from it gives promising indications of still further improvement in the writings as well as opinions of our various authors.

The increase in quantity of dental literature within the past three years has been, upon the whole, greater than ever before in the same period of time. Several text-books have been revised, improved, and brought to the present status of dental science and practice, among which are the following:

"Mechanical Dentistry," by Joseph Richardson, M.D., D.D.S. This as a text-book for prosthetic dentistry stands at the head of the list of all the works in the English language on this subject; it is well written, and includes almost every item of special value in this department of dental practice, while that which has become obsolete or worthless has been in the main omitted. Being better adapted to the use of the student than any other work of the kind, it has been adopted as a text-book in all dental colleges.

"Oral Surgery," by J. E. Garretson, M.D., D.D.S. This work has not only been thoroughly revised, but there has been added a large amount of original and valuable matter, and it is now a volume of about 900 pages. It is not only an important text-book for the student but an indispensable reference-book in the library of the practitioner.

"Dental Anatomy," by C. S. Tomes, the second edition of which was issued at the beginning of the present year, is a valuable work for the student, in that it occupies the ground of this special subject better than any treatise that has preceded it.

"A Manual of Dental Surgery and Pathology," by Alfred Coleman, L.R.C.P., L.D.S., etc., is a volume that has been revised and adapted

to the use of American students and practitioners by Thomas C. Stellwagen, M.D., D.D.S. It is profusely illustrated and contains much that is valuable, as a record of the results of long observation and experience must be.

"Oral Deformities and their Management," by Norman W. Kingsley, M.D., D.D.S., is a valuable addition to dental literature. It occupies a ground that has been wholly vacant hitherto, at least as to text-books, for while this subject had not been neglected the only publicity given it had been through articles in the various journals. The contents of this volume have nearly all been published in this way, but when thoroughly revised and prepared in its present form, making it available for student and practitioner, this work was at once adopted as a text-book in nearly if not all the dental colleges of the country.

"Plastics and Plastic Filling," by J. Foster Flagg, D.D.S. This is a well-written work issued within the past year. It embraces much that is of value and much about which there is great diversity of opinion. In it is given the experience, at least, of one who has devoted much time and investigation to the subject. While many points are clearly and fairly presented and discussed, there are many opinions advanced that show the positiveness and one-sided presentation of the special advocate.

These are only a small number of the books, in the English language pertaining to dental science and practice, that have been issued in the last three years.

Many of the works written in former years for our profession have for the most part attempted to cover too much ground, as for illustration, the works of Fitch, Harris, and Tomes; in which the subjects of anatomy, physiology, pathology, operative and prosthetic dentistry are all presented in one volume. This seemed to be, and no doubt was, at the time these books were written, a necessity, yet from our present stand-point it would have been better to have devoted a separate volume to each distinct subject and thus given them greater importance and made them, each, to stand out in bolder relief. Each subject could have been treated in a fuller and more satisfactory manner, and an increased number of volumes would have been added to our catalogue. One of the great needs of our profession is carefully-prepared text-books on dental science for students, for many of our best text-books do not meet the requirements of the pupil. Prepared with special reference to his wants, the subjects should be systematized and graded so that the

work of the student in this, his special education, as in any other, should be easily and regularly progressive, or ascending. There is in our literature very little that is in proper form for the student,—in the first year of his course, at least. Care should be exercised in the selection of text-books, and reference-books as well, for accuracy and clearness of statement are qualities of the first importance. Works of a controversial character are to be avoided, especially by the beginner, as they so often confuse rather than bring out the truth fully and clearly.

Books of reference for the advanced student and the practitioner should, in their turn, be free from all matter of a merely elementary character. There is therefore room, and I may say a demand for two or three distinct classes of treatise upon each branch or subject of dental science and art.

Books of an elementary nature are much needed, in addition to those we have, upon all branches of dental study and a wide field is open in this direction for the earnest, honest, and capable writers of our profession. But let no man write a book merely from a desire to become an author.

The *periodical* literature of our profession is assuming annually more and more importance, and it is, to some extent at least, trenching upon and even taking the place of our standard works. This is in some respects a misfortune, as the tendency now is to relegate our standard works to the position of reference-books merely, even those perfectly fitted for other uses.

Dental periodicals are not only increasing in number but are improving in quality.

There are now issued regularly in this country ten monthly dental journals, varying in size from thirty-two to sixty pages each, and four or five issued regularly in newspaper form; the latter are chiefly devoted to advertisements for manufacturers and dealers. These ten journals contain each month about 425 pages of matter, four-fifths of which is original, and a large proportion of this is of interest and real value to the profession, and of permanent worth, and much of only temporary interest. There is enough in each journal of real value to make every dentist who determines to be in the front rank willing to take the whole.

The first three dental journals ever published were American, and were published, one at Baltimore, the next in Cincinnati, and the next in Philadelphia. About the year 1856 the *British Journal of Dental Science* was established in London and has had a sturdy

life from that time to the present. There are now three dental journals published in London, all of much value to the profession.

There are in Paris three periodicals devoted to dental science and art; three in Germany, one in Italy, and one in Cuba. The latter two however, are mainly vehicles for translations from other journals.

From this it will be seen that the United States has a larger number of dental journals than all the world beside.

The ten dental journals of the United States contain each month 425 pages, or 5100 per year. The British journals contain 1692 pages per year, the German, 1984, the Italian and Spanish, 164, the French, 948, making in all 4824 pages. According to this estimate the periodical literature of the United States exceeds that of all other countries by 276 pages.

An important and rapidly-growing department of our literature, is found in the Transactions of our professional societies. The larger bodies, especially the National and State societies, and a few others, have published their proceedings in book form. These volumes usually contain the minutes, the papers or essays read, and the discussions upon them. In the early periods of associative work the proceedings were published only in the journals, but it was found to be impossible to do justice to the societies by this mode of recording their proceedings, and besides they were so much scattered, and intermingled, with other matter that satisfactory reference to such records was almost impossible; and still further, much of value was oftentimes omitted.

There have been published in this country about sixty volumes of Transactions of dental societies, varying in size from fifty to three hundred pages each. This body has published annually from its organization to the present time, a volume of its Transactions, and consequently has twenty-one volumes.

The Odontological Society of Great Britain, has also each year since its organization published its volumes of Transactions, and has now eighteen volumes. The dental societies of Germany are also issuing their Transactions in separate volumes. The works that have thus been issued contain some of the choicest matter of our literature, both in the matter and the manner of its presentation. The matter is usually prepared with thought and care, and with a consciousness that it will be subjected to criticism, and must stand the ordeal of free discussion.

DISCUSSIONS.

Professor Mayr. Dental journals as published at present to a large extent use the same words with a variety of meanings, so that it is many times very difficult for a careful reader to make different essays agree with each other. It seems to me that the subject of dental literature is closely connected with that of the reform of technical terms. Such terms should always have the same signification. Authors should be very careful to state what they mean by words used commonly in so many different senses. When I was so unfortunate as to be dragged into the business of editing a dental journal, I thought it would be necessary to give as an introduction to our journal a list of technical words, with the exact explanation of what we meant by them. I wish I had! Every one of you must have realized the difficulty of understanding the exact meaning of many essays. There are several dental journals published in Spain that are nothing but the English journals in the Spanish language, and the same may be said of the Italian journals. They are a reproduction of American and English journals, so that America has there a scientific influence on the Continent, which she does not have in any other branch of science.

There was another point that I had marked out as of importance, and that was with reference to text-books. Has any one of you read that little book published under the banner of Professor Flagg, of Philadelphia? I do not know if he wrote it, and I doubt if he did. There is nothing as funny in its line as that. It is said that good humor promotes digestion, and I recommend every one of you to read that book after dinner, if you are troubled with dyspepsia. In that book there are hardly a dozen scientific words that have a clear meaning. They are nothing but words, words, and empty words: a conglomeration of letters that may as well be divided anywhere else, as where they are. I hope that such books may not be adopted in our colleges.

Another point is with reference to standard books on chemistry. I think it belongs to the subject of literature, to inquire whether there exists a special chemistry for dentists, and if there exists any such book, I would warn teachers *not* to use it, because, if at the very commencement of a course you narrow the student's mind by making him believe that there is a special chemistry for dentists, another one for doctors, etc., he will learn no chemistry at all.

I have recently read the book on dental surgery and pathology, by Coleman, which is a very good work, except that the author, as it seemed to me, has neglected to notice properly the progress, in some departments, of the last ten years. Dr. Carl Heitzmann's name is mentioned rather incidentally only. The chapters added to the American edition have been thought by some to be only an advertisement of a certain firm, but I see much in them that is excellent. They are practical and give information as to where certain tools and instruments can be obtained. I consider the book valuable for students who wish to acquaint themselves, without much trouble with the topics treated in the book.

SECTION II.

Dental Education.

Report of the Section by J. N. CROUSE, Chairman.

CAN "anything new under the sun" be written on the subject of dental education, a subject that has been so much dwelt upon in our dental literature, and so often and so much discussed in our public meetings, is a question often asked. Much, we answer, remains to be said, and more especially to be done, before our profession can hope to rank as its importance demands.

The subject is occupying much of the thought of practitioners, as is evident from the fact that in no previous year has it received so much attention in both meetings and journals as during the past year.

Some new thoughts and plans have been presented, and old ones have been re-discussed, and yet we come together in this twenty-second meeting of our American Dental Association, no nearer any definite standard as to what constitutes a thoroughly educated dentist, and with no more unanimity of action among our educators than we had years ago. Let us look for a moment at some of the reasons why it has become a positive necessity to have a definite standard of education agreed upon by our educators and indorsed by a body like the American Dental Association.

State legislation, deciding what practitioners have a right to practice in the respective States, has become quite general. These laws require certain qualifications, but all of them recognize a diploma from a reputable dental college as sufficient evidence of qualification.

Then the question arises, is it to be taken for granted that all the dental colleges now existing, and those of the future, are to be considered reputable without question, and is a diploma from any dental college to be taken as sufficient evidence of the holder's qualification to practice? If not, how is a board of examiners to decide as to what colleges are entitled to the term reputable, and what ones are they to reject as not worthy of such recognition? With no fixed standard is it not an utter impossibility to decide this question? Some of the

State boards of examiners have refused to recognize diplomas from some of our colleges, and yet the same board may recognize diplomas from other colleges that are less reputable.

Is it just to those institutions that have the cause of education at heart, to rank them with those colleges that graduate students without regard to fitness or qualification? Why not let the first named institutions form an association and fix a standard of education requisite for graduation allowing any college to join the association which is willing to come up to the standard. This would debar no college that had the interests of the profession at heart, but would effectually exclude those that are gotten up from selfish or unworthy motives. How radical the requirements should be would, of course, be a matter for discussion, to be decided at a conference of the faculties of the different institutions. Your Section believe that the association thus formed could well afford to require all colleges to give at least two full courses of lectures before graduation.

There have been considerable discussion and unfavorable criticism on this point, growing out of the resolutions passed by this body refusing representation to any college faculty that did not require two full courses of lectures. We cannot understand why a system that is working so much injury to the cause of dental education in general should be continued on account of the hardship its discontinuance or a radical change might cause in a few individual cases. Where one student spends more time than is necessary in fitting himself for practice, fifty would be greatly benefited by spending more time in school. To allow a student to graduate on one course of lectures, and that after a very short one, is to lower very materially the average education of our graduates, and to lessen decidedly the value of a diploma as evidence of qualification.

Could such an association as has been suggested by your Section be formed, and the two years' course be adopted by it, with some of the other reforms, such as requiring a good English education and better training by their preceptors, as recommended in former years, then the State boards of examiners would have no difficulty in deciding as to what a reputable dental college means. Another advantage that would be gained would be in lessening the number of colleges. Some of the worthless ones now in operation would be discontinued, and many of the same class prospectively in store for us in the future would never come into existence. Notwithstanding the fact that the sentiment of this Association, and of the best practitioners everywhere, has been that there are too many dental schools in proportion

to the number of pupils, and the fact that several have gone out of existence, we have to-day nineteen (counting an embryonic one in Chicago), which is more than double the number in operation ten years ago, showing an increase in the number of schools out of all proportion to the increase of students.

DISCUSSIONS.

Dr. Robinson: I can hardly agree with the paper just read, that we have not made any progress in the forty-six years since I began practice. I can see such marked progress in every department of science, that I sometimes feel myself hardly in place in having a seat in this body. If I were to recommend any two things as being of the utmost importance to the young practitioner, the first would be that he should be an honest man in his education, both to himself and to his patrons. The second would be, that he must be fully imbued with the dignity of his calling, and act as though he were conferring a greater favor on his patrons by giving them the benefit of his knowledge and skill, than they were conferring on him by giving him their patronage.

Dr. Atkinson: It is in vain to attempt to elevate the standard of our profession so long as we follow the old lead. The idea of time having anything specifically to do with the granting of a diploma is of darkness and iniquity. I hold that any man who can prove that he is competent, should be so indorsed by those who have the power to give indorsement. One, two, three, or ten years has nothing to do with the acquirement of knowledge, only in a very insignificant sense. I am informed that there are schools that graduate on time whether students can answer the questions or not; and we have a school in New York, that upon a threat of a pupil whom they proposed to pluck gave him the diploma. Now the colleges want a little more pluck themselves, and they want to follow my old brother Jeremiah's method of doing things; learn to be honest themselves, and discriminate between applicants whether they are fit to study dentistry or not. That we have grown is evident, but have we grown to advantage? Is the fruit ripe, or only abundant and green? I take it that the latter is really true, and that the men among us who have the greatest ability are not the men who are regarded as literally well educated, but the men who had had instruction by reason of the honesty spoken of by

Dr. Robinson to comprehend what they were doing before they took hold of it, and then by religiously acquiring the knowledge before they offered their professional services to their fellow-men. It is this moral question that lies at the bottom—that we must inaugurate into our body as seekers for truth and as communicators of truth, if we wish to attain to a high standard of dental education.

Dr. Peirce: One word with reference to the remark made by Dr. Atkinson. He has struck the right key, but it does not harmonize with the present state of affairs. It is certainly a matter of indifference to the public where a professional man obtains his education. The work-bench or the college is equally acceptable, so that he possesses the requisite knowledge. But before this system of granting degrees, to which he has alluded, can be adopted, every State must have its board of examiners, and they must be beyond and above suspicion, competent in every department, and with the only authority to grant degrees or to license the professional man to pursue his calling; and for the government of this board there must be a fixed basis of qualification for the degree and an income independent of students. While our educational system is organized as to-day with the teacher dependent upon the student for his compensation and living, students must be required to spend a certain amount of time in the prosecution of their studies at college: for students to come before a board for the degree without reference to previous study, and that board depending upon the degrees conferred for a livelihood, would be a dangerous precedent to establish with the present status of humanity.

Dr. Barrett: That is the prettiest theory in the world, the idea of basing a diploma upon a man's qualifications and not upon the time that he has spent in the schools, or the place where he shall have obtained his knowledge. You have a practical exemplification of what that theory will degenerate into in the State of Wisconsin. Delavan diploma-mills may easily be the consequence. When it is left to the teachers in the schools to determine what the qualifications are that entitle a man to a diploma, some check is absolutely necessary upon the grinding out of diplomas, otherwise it lets down the bars and opens the field for all manner of fraud. In the State of New York the medical profession have attempted to take from the medical schools the authority to grant diplomas, and to confer that power upon a board which shall be in some way connected with the Board of Regents of the State University. It has not been found practicable as yet, because the colleges themselves are not agreed

upon it. The medical profession, I believe, would vote for it to-morrow, and some colleges also, but others of them do not desire to have the granting of diplomas restricted in any way further than by some limitation of time of study. I hope this reform will soon be brought about, and then it may be proper and possible to grant a diploma upon actual knowledge, no matter whether the student has attended the schools for any particular time or not; until such a system is established every one here can see how easily frauds might be committed, and how many diploma-mills would probably be organized, if self-constituted teachers were sustained by the dental profession in issuing diplomas on their examination alone.

Dr. Taft: The problems connected with the subject of education in our profession are many and difficult; they are not easy of solution. It is an easy matter to recount difficulties, but to devise the method of overcoming them is not so easy. It is true, that there is a diversity of procedure in different colleges, some pursuing one course and others another. If there is any power that can unify this work, can bring it upon a common level, it should be brought into exercise. It would be desirable to have the requirements for entrance into our colleges uniform. It would be well to have a common curriculum that should embrace the proper subjects for an accepted course. Let this be such as could be accepted by all as nearly as possible, then if any desired to extend the curriculum there could be no objection. With uniform requirements for admission, a uniform course of instruction, and uniform requirements for graduation, some of the evils at least that now attend our educational system would be greatly lessened, and perhaps removed altogether. How the concurrence of the various dental colleges could be secured for such a purpose, is not easy to determine. The time for it, if not already past, is now more favorable than it will be in the future; as colleges increase there will be a greater number, and perhaps greater variety of interests to harmonize. It may be that the power to accomplish this much desired end resides in the profession. But is the profession disposed to put forth any effort for the accomplishment of anything that shall improve our educational system? There was, some fifteen years ago, an association formed of the faculties of the various dental colleges in this country, and for a time it seemed to promise much for the future, but jealousies and antagonisms sprang up,—or rather existed from the first, and were permitted to grow till open rupture occurred,—and the withdrawal of two or three of the colleges resulted, while others became discouraged, and

the enterprise failed. But enough was done to demonstrate that by proper co-operation great good would have been accomplished, had the organization been maintained. Is not the time at hand when this can be done? Has not this body power and influence enough to aid and give encouragement to such an organization?

There has been for several years an association of the faculties of medical colleges, and great good has been accomplished by it. The American Medical Association encourages and fosters the association of college faculties. It has been suggested that the cause of dental education would be promoted by the examination of candidates for graduation by a board outside of and not connected with the colleges, and that the decision of such board should be final as to the fitness of the candidate. Experiments of this kind have been made in some instances, but never with any great degree of success. They have generally failed to learn the true standing of students, and in some instances have passed students who ought not to have passed, and occasionally have kept back those who were well qualified.

This body has from time to time passed resolutions bearing upon the subject of dental education. Such resolutions, though they have had some effect, have not remedied all the evils, but perhaps we should not be impatient; permanent institutions are of slow growth. I regard it as strictly within the province of this body to take cognizance of this subject, and act intelligently and wisely with the view of bringing about the best possible results. Without doubt one of the most important steps in this matter would be the organization and maintenance of an association of dental college faculties by which such regulations might be made as would result in some advance in the near future, and ultimately in great progress. For this at least let us work.

Dr. Allport: I desire to correct the statement made in the report by Dr. Crouse, that there is a dental college in embryo in Chicago. I presume I am as well informed in regard to this matter as any one, and, so far as I am aware, there is no intention to start a dental college in Chicago.

While no one can appreciate more fully than I do the great benefits which we have derived from dental colleges, in my judgment, they have nearly served their purpose, and we now need something different and better—namely, a fuller and more complete medical education on the part of dentists than is now afforded in these colleges; and I may add that medical graduates need a better education than is now afforded in our medical colleges. Just what is to be

done in Chicago in regard to these matters is not yet fully determined; but, if anything, it will be in the way of supplying these two deficiencies.

As reference has been made to the movement contemplated in Chicago, I think it will be well to state just what has been done, as well as what is also proposed. On several occasions during the past few years, professors in two or three of our medical colleges have discussed the idea of establishing dental departments or colleges in connection with their respective schools, but believing that we have already dental colleges enough, the project has been opposed by nearly all of our best dentists. Less than a year ago, the idea was again revived by one of these leading schools, and I, with other dentists, was asked to join in the undertaking. Feeling, as I have just stated, that dentists need a better medical education, and that physicians need a better dental education than is now afforded in their respective schools, I suggested the advisability of establishing chairs on dental diseases in all of our medical colleges, irrespective of pathies, and of exacting of all their graduates the same degree of knowledge in regard to dental diseases and the science of their treatment, as is exacted in regard to any and all other diseases, and that all students, no matter whether they intend to engage in the general practice of medicine, or to pay their special attention to skin diseases, general surgery, or dental surgery, should matriculate as medical students, and when qualified, graduate as doctors of medicine.

It will be seen that the establishment of these chairs, so far as practical dentistry is concerned, means nothing; for quite as good, or even better dental instruction for the practice of dental surgery could be secured in any of our dental colleges; the object in this case being to impart to the general practitioner such knowledge in regard to dental diseases and what constitutes good dental treatment, as is not given in any of our medical colleges. In this way they will be better able to judge of the necessary qualifications of a good dentist than they now are, so that they may wisely select those whose medical education is such as to make them wise counselors as to dental complications, and their treatment. We all know that in the present state of dental knowledge on the part of physicians, they are quite as apt to call in consultation the worst tooth-carpenters we have, as they are to call our best-educated dentists. With them, a dentist means a man who can extract or fill teeth and put in artificial teeth, without regard to medical knowledge; and often our biggest dental

quacks are regarded quite as highly by the family physician as are those whom we would regard as qualified to diagnose and treat the various diseases directly or remotely connected with the teeth. In treating the eye or other organs of the body, the regular practitioner hesitates to consult with, or to recommend his patients to any but regular graduates of medicine who make the treatment of any particular class of disease a specialty; but in dental diseases, almost anybody will answer.

By so educating physicians that they will see the importance of a medical education in order to intelligently treat dental diseases, it is hoped that they will exact the same degree of medical knowledge on the part of the dental surgeon that they now exact on the part of the ophthalmologist. Could all of our medical colleges be induced to establish these chairs so that their future graduates would be properly educated, their influence would be so great in regard to this matter, that in a few years the dental surgeon would be forced to become a fully-educated medical man.

For manipulative training, and the application of medical science in the treatment of dental diseases, I suggested the establishing of a dental infirmary, which should be open to the students and graduates of all medical schools upon an equal footing, irrespective of pathies. In this infirmary I suggested that there should be such didactic teaching as would be essential to the medically-educated man in the treatment of dental diseases, together with such digital training as would make them skillful manipulators. By the establishment of dental chairs in our medical colleges, the dental and general education of their graduates would be so complete that but little more than manipulative dental training would be necessary in this infirmary in order to qualify young men to become intelligent and skillful dental surgeons. For this teaching I suggested the establishing of a corps of clinical teachers, selected from our very best practitioners, so that students could have the advantage of the best manipulative training possible, and upon the same footing as the medical graduate who purposes to enter upon the practice of any other department of medicine, (and who receives instruction in hospitals and infirmaries devoted to surgery, gynecology, and ophthalmology, from the most experienced and skilled in those departments). When these dental students had become qualified to enter upon the practice of dental surgery as a specialty in medicine, they should receive certificates of such qualification from the officers in charge of the infirmary. This proposition met with the approval of all

present. Although sanguine, myself, as to the advisability of this method of teaching, I presumed it would be opposed by the faculties of our medical colleges; judge then, of my surprise, when not a single teacher belonging to our seven medical colleges in Chicago opposed the idea, and six out of the seven colleges have already established either lectureships or professorships in regard to dental pathology and surgery, and I am assured that the seventh will do it as soon as the place can be properly filled. The dental infirmary is not yet organized, but it is hoped that it will be before the close of the coming sessions of our medical colleges. This is, in few words, about the status of the undertaking spoken of in the report.

Dr. Buckingham: If we could all agree upon what should be taught to students, we should have no difficulty, but while we have no such agreement, we must have these various modes of instruction. It does look to me to be the most sensible mode of teaching to teach a man what he is to practice. To teach him some branch as a mere ornament to his profession does not appear to me to be desirable. I admit there is a variation in our teaching. There will and must be while there are various colleges. If we were under a general government like that of England or Prussia, we could have a uniform system, and could demand that no man should practice a profession unless he had passed through one of the State institutions, but we have about one hundred and fifty medical colleges, all over the country. Every little town and village has a medical college of some kind or other. A college is like every other institution; it must live, and in order to live it must have students, and when you set the standard so high that the students will not come there, the professors will not work, for they cannot without some compensation. It is glory probably for the first year, but glory does not feed a man long, and without a paying patronage you will find your professors sliding out one after another until the institution gets into the hands of parties who will run it for their own interests. I could point you to two colleges particularly where this has occurred, one of which stood high. The charge that good men will take students merely to get their money is not true.

Dr. Morgan: To propose to educate men and to graduate them on the ground of the time they shall have been engaged in study, is a snare and a delusion. I would ask gentlemen who are advancing that idea, if they have ever met any man that they thought would be too well qualified to practice dentistry after having taken the full course of lectures? Is the time going to hurt them? Is

there any injury done them? Are any of their rights trampled upon? None whatever. They have no right in college until they enter there, and when they enter they tacitly agree to abide by the laws of the college. There is no wrong to any one because they are entitled to remain two years or five years. The charge that men have graduated because they have attended two full courses, without regard to their qualifications is, I believe, a slander. Some men get through that are not thoroughly qualified, and they may want instruction in many things, but the guiding principle of men who are honest in their profession and who desire to do well by their students does not sanction such a course. With reference to an examining board outside of the institution, I think no man is so capable of examining a student as the man who has taught him. No man can ascertain so nearly his qualifications as the man who has been through the infirmary and the laboratory with him, who has lectured him time and again, and examined him from day to day upon subjects which he has been taught. I know men who, when they come before the faculty with whom they are well acquainted, are sometimes so abashed and embarrassed that it is impossible to get a respectable examination out of them. I examined a student not long ago who had taken his M.D., who had been through an excellent medical institution and he could scarcely answer half of a dozen questions in anatomy, such was his embarrassment. Are you going to increase that embarrassment and thereby do him an injustice by placing him before a board of examiners with whom he has no acquaintance, and who have no knowledge of his ability or capacity. You cannot bring in a board of examiners who can look at a man and tell what his capacity is; you must know him, you must have intercourse with him, you must understand his character and his mode of thought before you can judge of the extent of his qualifications, and I contend that, for that reason, it would be unjust and wrong, a stumbling-block to the profession, to adopt such a system of examination. We ought to have some standard of qualification established. There ought to be some unity of action between the different dental faculties in this country by which we could fix some standard. Some of the southern States have passed laws requiring every man to have a license before entering practice. Such laws have been passed in Alabama and Georgia; so that, if a man comes from Harvard University with his diploma, he has to go before the board to get his license, and if they see fit, they have a right to go behind his diploma and examine him, and to deny him the privilege of practicing dentistry, if they see he is

not qualified. It gives them an opportunity to discriminate between colleges which are honest in what they are doing and those which are not. I am glad of it. The scheme of having chairs in medical colleges for the purpose of teaching the institutes of dentistry is another delusion. It has never been adopted in a single case where it has not proved a curse. Take the experience of the gentlemen who have taught in the State of Iowa, where they had a chair in a medical college that was always filled by men of talent and high qualifications, and the experience of every one of the professors who has occupied that chair is such that they are opposed *in toto* to such an arrangement. They found that the poor medical students, those of little qualifications, when they went out into the country to practice, would send into the depôts and buy a little kit of tools and stick them in one end of their saddle-bags, and then they would go around pulling teeth here and stuffing teeth there with amalgam, and bringing disgrace upon the dental profession. I have had an opportunity to observe this thing in another school. If they are taught a little dentistry they go out to practice, and if they fail in practicing medicine they turn around and practice dentistry. I dread the day when our Chicago friends adopt any such system. It will prove a curse, and the oldest man among them will scarcely get out of the world before seeing the evil that has been brought upon the profession. I know where three or four students were required to pass a preliminary examination, and where they could not come up to the standard, they marched right out and went to a neighboring college and wrote their names upon a register and entered, and some of them graduated the first year without attending one full course. That sort of thing is going on in this country, and my impression is that the less association you have between the medical profession and the dental profession in teaching, the better it will be, except as a foundation to build a dental education on. Some gentlemen say they want a broad education. I have no objection. Make it as broad as you please, and the course as long as you please, but qualify men to practice dentistry in a dental college taught by dental men—men who understand what they are teaching, and what they are teaching it for. Tell me a man is qualified to teach an individual science that he has to apply in a certain direction, who knows nothing about the application that is to be made of it? He must know something of the application of the science which he is teaching for a special purpose, or the student who comes out and attempts to apply it for that purpose will fall very far short. It is so in the

very nature of the case. The motive which underlies this idea of connecting our dental and medical teachings, of qualifying men to go out from medical colleges with an M.D., for the purpose of practicing dentistry, is because they have a sort of notion that M.D. indicates a higher education, that it is a little more honorable, that it takes them into a higher class of associations. Is that true? I think not. I think the history of the medical profession in this country, with all its "isms" and heresies set up here and there, ought to be enough to deter any man who proposes to practice dentistry from going into it at all. He ought to go elsewhere to qualify himself. Would an M.D. be any evidence whatever? Take an M.D. of the present day—go down into your city—select the most prominent one there, a man who is known throughout the community as an M.D., and who is worthy of the degree; how much evidence is it to me that he is qualified to practice dentistry. Whenever you make that the *sine qua non*, that every man who goes into dentistry must be an M.D., without any title to show that he has studied dentistry, you open the door to every quack doctor in the land to march in with his kit of tools and proclaim himself a dentist, and there is no man to say whether he is or is not. You open the door and invite into the dental profession all that class who are failures in the practice of medicine, without any evidence of their qualifications, and without the knowledge that they have been to a place where they could qualify themselves to practice. I do not think the profession are ready for that sort of move, and I am confident that if they take it, it will work serious ill consequences to them.

Dr. Brophy: We have heard for a number of years arguments similar to those which have been brought forward by Dr. Morgan, and we have also heard arguments which have caused us to feel that physicians should know something of the diseases of the teeth. I would like to ask the gentleman if he can expect the eminent medical man whom he has mentioned as living in this city to know all about dental diseases. Certainly he cannot. He had no opportunity to learn anything in regard to dental pathology and dental surgery. Is that an argument against us? Most assuredly not. Those who enter upon the general practice of medicine, if they are as familiar with the diseases of the teeth as they are with the diseases of the eye and ear, will be more intelligently prepared to diagnose those eases and send them to men of intelligence who can properly treat them. In the city of Chicago I met a young man, only last week, who had received a thorough medical education in

one of the schools from which he graduated. He had graduated from the literary department of Yale College, from Rush Medical College, from Bellevue Hospital Medical College, had been a student three years in Vienna; and that man did not know the difference between an educated and intelligent dentist and the most consummate quack in our city to whom he was sending some of his best patients. Why? Because there was in the college in which he had received his education the lack of teaching which he should have had. Would Dr. Morgan charge the physician who has not had the opportunity of studying diseases of the eye and ear with ignorance, because he has not had such opportunities, or would he lay the fault to the institution which has not furnished him with the opportunities? In most of the States they have laws which require that men shall be educated in certain manipulative parts of dentistry, they shall be able to do certain operations, and they put them to a thorough test. I know our board do. Now, sir, it is impossible with the course that is marked out in Chicago for any of these young physicians to go forth and enter upon the practice of dentistry or the filling of a tooth with the few instruments that they have in one end of their saddle-bags, because the State law will not permit it. They may go on and practice medicine, but they cannot enter upon the practice of dental operations or the manipulations of dentistry. This absolutely and completely precludes any quackery from the medical men who have been trained in dental manipulation or in dental surgery. Dentistry is not confined to the simple filling of a tooth and the construction of artificial teeth. It embraces for its field of operation a portion of surgery and pathology and all the familiar principles of medicine, and where can these principles be best taught? Can they not be best taught in medical schools by teachers who have spent the best portion of their lives in informing themselves so that they can understand the principles and demonstrate them? Most assuredly. It is not the intention of this movement in Chicago to establish a dental college. It is designed to place dentistry in precisely the same position that is occupied by ophthalmology and other medical specialties. Students receive their education in medical colleges. They have obtained their degree of M.D., provided they are qualified, and after this, if they can pass a satisfactory examination before the board of examiners of the infirmary which is expected to be established, then they are qualified to enter upon the practice of dentistry, but not until then. Furthermore, if they were to commence, our State board would be after them, and they would

find themselves in trouble. I do not like to hear gentlemen argue and speak so disparagingly of the profession from which we arose. I think it is an argument in the wrong direction. I honor and respect too much the eminent medical men from whom most of our medical knowledge has been derived; who, indeed, are the authors of all our dental text-books with one or two exceptions. These are the sentiments which I wish to offer. We want the men who practice medicine to know something about the teeth. It is with them that the care of the teeth of the American citizen rests. They can accomplish more in the prevention of decay of the teeth than all the dentists in America to-day.

Dr. Kulp: As Dr. Morgan alluded to our experiment in Iowa, I wish to explain. Twelve or thirteen years ago, when the medical department of the State University was established, the medical faculty invited us to a place in their school—to a chair on dental science. Dr. Wilson, who is present, and myself, were invited to deliver the lectures. We delivered four lectures each during the session for two years; we failed in accomplishing all that we hoped for in the start, but we, perhaps, did a little more than we intended to, for after a few years we found many of the young M.D.'s who graduated in those two sessions were practicing dentistry all over the State in the country towns. I would at times receive letters from young men asking my advice on some particular subject. I would give them advice, thinking it was some case in which it would be necessary for them to do something for the relief of their patients, but I very soon discovered that these men were practicing dentistry, and in the meantime we had circulars flying all over the State, informing us that the Iowa Dental Manufacturing Company was established, with headquarters in Des Moines,—and they were scattered in every community; we learned that these young M.D.'s were extracting the teeth, while they had their "dental men" taking the impressions and sending the models down to headquarters, who would in time return the plates and they were fitted in by the M.D.'s. We protested very strongly to the medical faculty. We told them we would have nothing further to do with their institution unless they stopped that sort of procedure They instituted some pretty strenuous measures, and did stop it to some extent. There are a few who are still at it but we have cut them off now in our State law. What I want to emphasize is that our experience with the plan, that started out on the very same principle that these good men from Chicago are starting out with, has been very much

against the method. My observation of twelve or fourteen years with that sort of work is, that it will bring a curse upon the dental profession. That is my prophecy, and if it does not prove true you can put me down as no prophet.

Dr. ALLPORT: Dr. Morgan seems to have a very great aversion to prospective practitioners of dentistry having anything to do with medical colleges or medical teachers; now I would like to ask the gentleman one square, honest question: did he not when he decided to educate his own son as a dentist put him into a medical college and graduate him as an M D. previous to his instruction in a dental college? and does he not advise all young men to follow the same course if they desire to take a front rank as practitioners of dental surgery?

Dr. MORGAN: I think a medical education is a first-rate foundation upon which to build a dental education, and I have no objection to it in that form, but a man should have a dental education aside from the medical.

Dr. ALLPORT: One thing more. Our friend Dr. Kulp seems much afraid that medical graduates who know anything about diseases of the teeth, will be tinkering at dentistry around the country, and become dental quacks. Did the doctor ever know bigger quacks than come from some of our dental colleges? We have not in Chicago to-day greater quacks than some of our dental graduates; but this is no argument against dental colleges. You cannot make respectable people of everybody, either with or without an education. It is the individual and not education that makes the quack. The question whether a medical education is essential or not to the intelligent practice of dentistry, is determined by the question, whether dentistry is an independent profession or a specialty in medicine. If the latter, it should take the same course that other specialties do. First lay the foundations broad and deep in the science of medicine, and then build our specialty upon it, the same as the specialties in law are built upon the great and fundamental principles of justice as laid down in the comprehensive teachings of such jurists and pleaders as Blackstone, Coke, and Chitty. The idea of undertaking to build up an independent profession (as some claim that dentistry is) out of a segment of a profession, is nonsense; we have been at it long enough; let us go to work and lay our foundations deep and broad in the science of medicine, and then we shall have something upon which to build an intelligent practice. If the science of medicine forms a basis upon which all diseases are treated, it would be as consistent to undertake to build up a distinct

profession in the practice of criminal law, or admiralty or commercial law, without a knowledge of the principles of general law, as to undertake to build up a separate profession out of the treatment of any particular class of diseases, when a general knowledge of medicine is essential at every step in the treatment. A knowledge of anatomy and pathology is requisite in the treatment of all classes of disease, and this knowledge must be acquired from medical text-books, which discuss the principles underlying the general practice of medicine; and it is from these books that we get all the knowledge we have of general principles. It is upon these principles that all medical teachings in our dental colleges are based, as well as all books that relate to our special practice. And to pretend that dental surgery is an independent profession when not an intelligent step can be taken in its practice without medical knowledge is simply absurd. Without this medical knowledge it is not a profession—it is a trade; and it is a specialty in medicine just in proportion as the practitioner is medically educated. When dental education is established upon these principles we shall have genuine dental surgeons, but until then we shall not.

Dr. E. Hunter: If it is a fact, as gentlemen say, that the greatest quacks that are in the dental profession (and it will not be denied) are graduates of colleges, it seems to me very evident that some other than an educational standard should be adopted for admitting candidates into our offices as well as colleges. Adaptability for any employment or profession, it seems to me, should be the requirement for entering upon a life-work. Time is too precious to be thrown away on any special employment where nature has refused a special liberal endowment in that direction. To encourage a young person to enter the dental profession without good natural abilities for that, including sterling integrity, is to blight his life-work, when in some proper sphere he could be a blessing to himself and humanity. There should be no guess-work about so important a matter as that. Let no young man be encouraged to make an attempt that will only end in his being denounced as charlatan, empiric, and quack. A man must be born a dentist to ever become proficient as such. The capacity for becoming a dentist, physician, mathematician, or orator, can never be bought with money or attained by a college course of any number of years. If parents have been illiberal in laying a foundation for special education, it is, to say the least, a mistake to enter upon that for a life-work. If parents have endowed a child with genius, he may rise from obscurity and poverty to the highest

eminence without the benefits of a college course. Of course, education can do its best work for such an individual. Favorable parentage makes one master of circumstances. Though he dine upon a baker's roll while walking the streets, or splits the rails to fence his father's or neighbor's corn, he may grace kingly courts or rule a nation, and with his magic pen transform millions of slaves into freemen, though a college might never have been honored by his presence. Open the professional doors to none who have not the capacity for the specialty, and the problem of dental education will be easily and speedily solved.

Dr. Buckingham: It appears remarkably strange to me that the dentists are not competent to teach dentistry—that all these men who are talking here do not know enough of physiology, anatomy, and medicine, to teach dentistry.

Dr. Morgan: With regard to the breadth of education. What is the reason you cannot educate a man well and thoroughly in a dental college? Why cannot you provide for teaching anatomy, physiology and chemistry? In the institution with which I am connected these branches are provided for. Why do you want to run after medical men who are directing their teaching in another line? Why not teach it in your own particular line? It was said here that I had said something disrespectful of the medical profession. I did not do any such thing. I said that the most distinguished medical man in this city was not able to practice dentistry, and he will tell you exactly the same thing, and he would not consider it disrespectful if I should say to him, you do not know how to teach it. But there are gentlemen here who do speak disrespectfully of the profession, in saying they do not know enough to teach the students who go into their institution what they ought to know, that they ought to teach them everything about dental diseases but cannot. You are the gentlemen who are disparaging the medical profession, while I hold them up as honorable men, especially those who are doctors of medicine in truth.

Dr. Robinson: I want to say, that while I fully agree with Dr. Allport, that a medical man should be a good dentist,—and I have had large experience,—I never have known one man who was a doctor of medicine and a dentist to be the very best without he was a dentist first before he was a doctor of medicine.

VOLUNTARY PAPER.

VOLUNTARY PAPER BY JOSEPH RICHARDSON, OF TERRE HAUTE, IND.

Reflex Lesions of the Oral Cavity Associated with Pregnancy.

AT a late meeting of the Indiana State Dental Association, it was my privilege to read before that body a paper entitled "Correlated Diseases of the Teeth and Ear." The purpose of the paper was to present some ascertained facts in regard to the reflex nervous relationship between the teeth and the various structures of the auditory apparatus, and to account for the manner in which not only functional but nutritive or trophic diseases of the latter occurred, as a sequence of irritation having its source primarily in the teeth or gums.

Researches directed to the ascertainment of sympathetic relationships of other organs, as the eye, brain, stomach, uterus, etc., would probably reveal them also as so many areas correlated in like manner as the ear to primary disorders of the organs of the mouth.

It is not my present purpose, however, to consider further the reflex diseases of organs or regions remote from the mouth, but to reverse the order of inquiry, and trace, if possible, the sympathetic dependency of certain disorders of the teeth upon functional disturbances or structural lesions primarily located in some remote part of the general organism; premising that a better understanding of the laws of reflex action, a more familiar and exact acquaintance with nerve-function, and a clearer insight into the correlated areas existing between widely-separated regions, would lead to more rational and trustworthy views of the etiology of many sympathetic disorders of the buccal cavity, the origin and nature of which are to us as yet measurably a sealed book.

In the discussion of my subject I shall, in order to confine myself within reasonable limits, consider only certain abnormal or pathological states of the oral cavity very frequently associated with pregnancy.

The thought may occur to some that, as utero-gestation is essentially a physiological act, it could not give rise to such irritation as

would establish sympathetic affections of the teeth; and this would doubtless be true if the uterine functions were always normally performed. But the simple fact that the reproductive act is, ordinarily, a *conscious* one, leads obviously to the conclusion of functional derangement, for the senses take no cognizance of the normal processes of organic life, and hence no one in perfect health is supposed to have, through the medium of common sensation, any mental perception of a brain, stomach, heart, liver, or uterus. The frequency of oral disorders coincident with pregnancy is, in itself, presumptive evidence of generally perturbed uterine function more or less severe and persistent.

Before proceeding to point out the nervous relationship between the uterus and the oral cavity, it would seem pertinent to examine briefly the generally-accepted theory in explanation of certain pathological states of the organs of the mouth associated with gestation. The prevailing view, I believe, is that the more rapid decay of the teeth characterizing this period is due to the increased consumption of lime-salts incident to fœtal growth and development, and that this superadded draft upon the calcific elements of the maternal circulation, by diverting the lime-salts from the teeth, impairs the organic integrity of the latter, producing a nutritive lesion characterized by diminished ossific deposits and a corresponding domination of the animal constituents—in other words *softening*, a condition rightly supposed to favor accelerated decay. This theory would seem to be predicated on the assumption that the bone-producing elements supplied by the ingesta are, in the unimpregnated state, largely if not wholly appropriated by the tissues into which they enter as a component,—that there is not, ordinarily, any adequate provision in the way of excess for the demands of a process of Divine ordination, and that when the exigency occurs, it becomes, as between the mother's teeth and the fœtus, a simple question of *divide*.

Now, aside from comparatively infrequent cases of tissue-starvation consequent on pronounced deficiency of the bone-producing elements in the food, it would seem but rational to suppose that there is, ordinarily, a *surplus* of the lime-salts in the circulation, adequate for all the contingent needs of both mother and child. If this were not so,—if in the unimpregnated state there were but a simple sufficiency of the lime-salts for the ordinary purposes of growth and repair, in pregnancy, the fœtal processes of ossification would suffer in common with the mother's teeth whenever the

demand for a largely increased supply occurred. As a necessary result of such imperfect provision of calcific matter during the period of fœtal evolution, we should expect to find, in after life, osteological malformations a characteristic inheritance of the human race,—an infirmity by no means common. If this theory of diversion, or robbing Peter to pay Paul, predicated on the assumption of insufficient supply for mother and child is, as I believe it to be, neither rational nor physiological, nor in accordance with any just interpretation of the laws of nutrition, far less is it acceptable as an explanation of other oral phenomena associated with gestation. While it might account for increased sensitiveness of tooth-bone to mechanical or chemical stimuli where decay exists, it is hardly competent to explain the distressing and oftentimes violent pains located in teeth but slightly decayed, or even of unbroken structure, and which are clearly distinguishable from mere hyper-sensitiveness; nor does it in any manner explain the presence of those various neuralgic affections of neighboring parts coincident with impregnation.

We must look further, then, I think, for some more rational solution of the problem of causation as it relates to the oral phenomena coincident with the reproductive processes. A more plausible and defensible theory, I believe, would assign to these phenomena the character of reflex lesions, structural or functional. To justify this conclusion, I shall first endeavor to ascertain if the organs of the mouth constitute an area correlated to the uterus through the medium of the sympathetic system of nerves, and then consider in what manner the vaso-motor fibres of that system operate as factors in the production of the oral phenomena which I have characterized as reflex lesions. It is important to remember in this connection the essential facts now broadly recognized by modern physiologists, namely, that, with few exceptions, all sensori-motor nerves comprise fibres belonging to the vaso-motor system; that the latter are largely distributed to the blood-vessels; and that their peculiar and distinctive office is to control and regulate the calibre of the vessels to which they are distributed, and consequently the blood-supply to any given part. First, then, do the teeth constitute an area correlated to the uterus through the medium of the sympathetic system of nerves? Such a relationship, I think, is sufficiently obvious, and may be traced as follows: The blood-supply to the teeth is derived from the external carotid artery through its branches, the inferior dental and alveolar branch of the internal maxillary arteries, and the vaso-motor nerves controlling the calibre of these vessels are derived from the

external carotid plexus of the sympathetic,—a plexus derived immediately from the superior cervical ganglion. The uterus, its appendages, and the vaginal walls, are supplied with nerves from the pelvic plexus of the sympathetic, which brings these several parts into immediate relation to the spinal sympathetic system. Thus it will be seen that any tissue-impression having its origin in the uterus or associated structures, would be transmitted by way of the afferent vaso-motor fibres to the vaso-motor centre in the medulla, and returning by the efferent fibres in reflex relationship with the former, would reach the carotid sympathetic plexus through the superior cervical ganglion. As the branches of the external carotid artery, to which this plexus is distributed, supply the teeth with blood-vessels, it is not difficult, I think, to see how the teeth of the superior and inferior maxillæ become an area correlated to the uterus through the medium of the carotid plexus of the sympathetic system.

Assuming the correctness of this view of the relationship of the regions under consideration, it only remains to ascertain how, through the action of the vaso-motor nerves, nutritive lesions or reflex functional disturbances in connection with the teeth may occur as a sequence of irritation having its source in the gravid uterus, its appendages, or the vaginal walls.

Dr. Charles H. Burnett, in a treatise on the Ear, says: "It may be stated in a general way that *the effect of any irritation in a vaso-motor nerve-tract may be to excite vessel-dilatation through diminished inhibitory nerve-power, in a correlated area.*" Accepting this statement as an ascertained physiological fact, we should have, as the result of any irritation having its source in the uterus or its associated parts, impaired tonicity of the pulp-vessels, manifesting itself in *dilatation* and consequent congestion or hyperæmia. If the disturbance in the pelvic region were such as to produce only slight irritation, the reflex lesion of the pulp would manifest itself as a so-called sympathetic neuralgia consequent on pressure of nerve-fibrils by engorgement and distension of the blood-vessels. These sympathetic neuralgias of the teeth, of either sound or unsound structure, are very commonly associated with pregnancy, and cannot be rationally accounted for, I apprehend, except in the manner here indicated. Ordinarily, the exciting cause would probably be insufficient to induce more than mere functional disturbance in the pulp, but it is easy to see how reflex irritations of sufficient intensity and perseverance might induce blood-stasis, inflammation, and disorganization or death of the pulp.

Now, let us apply the facts and conclusions of this paper in explanation of the phenomena of *softening* and the more rapid decay of the teeth during the period of gestation. The lesion is clearly a reflex one. Anything like habitual hyperæmia of the vessels of the pulp must, by altering or diminishing the blood-supply, more or less seriously interfere with the nutritive processes concerned in the reparation of wasting tissues. The consequence of such modification or interference with the normal functions of the pulp, so far as its vessels are concerned in the nutrition of the teeth, would be in the direction of degeneracy or retrograde metamorphosis of tooth-structure. This would imply, we may suppose, defective assimilation of ossific matter for purposes of repair, and certainly diminished vital resistance to the action of agents operative in producing solution of the lime-salts.

We should have, consequently, from the operation of these causes, a tendency to general softening, hyper-sensitiveness, and greatly increased rapidity of decay. These are frequent complications coincident with pregnancy, are always more or less distressing and harmful, and often involve the loss of valuable organs. The subject is therefore one of great interest to us as oral specialists.

By request of the author, the following, as having some pertinent relation to the subject-matter discussed in the foregoing paper, is appended:

"*Storage and Utilization of Phosphates in Pregnancy.*—In a recent number of the *Union Medicale*, Dr. Delattre discusses a phenomenon of early pregnancy which he considers has not hitherto received the attention which, both on physiological and therapeutical grounds, it deserves. He refers to the almost complete disappearance of the phosphates from the urine. These salts, he says, are, except the small proportion as yet required by the development of the fœtus, either stored up in the maternal bones, which increase in weight and density, or, occasionally, deposited on their surface in the form of osteophytes, which have long been looked upon as errors of nutrition. In the later months, when the fœtal bones are growing and ossifying rapidly, these reserves are drawn on, and the osteophytes, if present, disappear. The absorption is not complete at the time when the child is born, but goes on during the normal time of lactation, supplying phosphates to the milk. Such is the course of events in the case of a healthy and well-nourished woman."

STANDING RESOLUTIONS.

The following standing resolutions are in force at this time, August 1, 1882.

Resolved, That henceforth no person shall be received as a delegate who is in arrears for dues, or until he has paid to the Treasurer the full amount due at the time his name was dropped for non-payment.

Adopted August, 1874.

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Adopted August, 1879.

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Adopted August, 1880.

Resolved, That hereafter no society shall be entitled to representation in this Association that does not require it members to live up to the requirements of our Code of Ethics.

Resolved, When it comes to the knowledge of the Committee on Credentials that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are, and in no case shall this Association be compelled to treat with violations of the Code, except where the violator is a member of this body and has no membership in any local society.

Adopted 1881.

Resolved, That the Secretary be instructed to assign members who may neglect to make their own choice the Section in which they are expected to work.

Adopted 1879.

Resolved, That the reports of Sections shall be called by the President in consecutive order, beginning each succeeding year one number higher than on the preceding year.

1879	commencing	with	No. I.
1880	"	"	No. II.
1881	"	"	No. III.
1882	"	"	No. IV.
1883	"	"	No. V.
1884	"	"	No. VI.
1885	"	"	No. VII.
1886	"	"	No. I.

Adopted 1879.

Resolved, That from and after this date, the Treasurer of this Association shall be required to give such bonds for the faithful discharge of the duties devolving upon his office, as the second division of the Executive Committee may deem necessary, and his predecessor shall not surrender the funds, books, or papers, until he is informed by said Executive Committee that such bonds have been executed.

This was adopted 1882.